**Department of Energy**

ROCKY FLATS FIELD OFFICE
P.O. BOX 928
GOLDEN, COLORADO 80402-0928

JAN 22 1997

97-DOE-05005

Ms. Susan Chaki
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
4300 East Cherry Creek Drive South
Denver, Colorado 80222-1530

Dear Ms. Chaki:

This letter is in response to a request from D. Ikenberry of the Colorado Department of Public Health and Environment (CDPHE). A copy of Appendix J, Comment/Response for the Phase I Interim Measure/Interim Remedial Action (IM/IRA) Decision Document and Closure Plan for Operable Unit 7 Present Landfill, is being provided for transmittal. Operable Unit 7 is currently unfunded due to its low potential risk on the Environmental Ranking List. The resolution of the comment/response cannot occur until a budget is established for not only the Decision Document but also to fund the Title II effort and the remedial action/final closure. It is not practical to resolve, at this time, the outstanding comments of the Decision Document and obtain public approval without following through with Title II design and the construction effort.

If you should have any questions regarding this transmittal, please contact me at (303) 966-3424 or Norma I. Castaneda at (303) 966-4226.

Sincerely,

Gail S. Hill

Gail S. Hill, Acting Lead
Regulatory Liaison Group

Enclosure

cc w/o Enc:
J. Legare, AMEC, RFFO
R. Tyler, ER/WM, RFFO
N. Castaneda, ER/WM, RFFO
J. Kerridge, PLD, RFFO
J. Rampe, PLD, RFFO
A. Sieben, KH
A. Tyson, RMRS

This appendix provides responses to comments received in June from EPA and in August from CDPHE on the March 1996 draft Phase I Interim Measure/Interim Response Action Decision Document and Closure Plan for Operable Unit 7, Present Landfill. Comments and responses on the August 1995 draft Phase I IM/IRA DD are presented in Appendix J.

Where the comments on the March 1996 draft relates to a comment/response pair in the August 1995 draft Appendix J, the original comment and response reproduced here. The original comment and response are underlined.

## EPA COMMENTS

### EPA March 1996
### Comment 1, Page J-1
### Risk Assessment

Methodologies to evaluate both human health and ecological risks are unacceptable. Several complete exposure pathways were not considered in the human health risk assessment in the OU 7 DD. In addition, many human health risk assessment methods do not conform to EPA guidance (EPA 1989, 1991a). In particular, the use of invalidated data and comparison of mean chemical concentrations to applicable or relevant and appropriate requirements (ARARs). Unless these deficiencies are corrected, risk to human receptors may be significantly underestimated. The conclusion that there is no risk to wildlife at the East Landfill Pond surface water and sediments was arbitrary in that it contradicted the results of the focused risk assessment for these media, and it was based on incorrect water quality standards.

### Response

*For the revised document, human health risks have been evaluated only for the open-space exposure scenario because this is the anticipated future land use for the area surrounding the landfill as recommended by the Future Land-Use Working Group (DOE 1995). Exposure pathways for occupational scenarios are incomplete because industrial development at OU 7 will not be possible due to land-use restrictions (deed restrictions and/or state orders) after construction of the landfill cap. The ecological worker scenario was not evaluated because the open-space scenario is more conservative.*

*Risks will be recalculated using validated data only (i.e., eliminating 1990 data). Mean chemical concentrations, as well as maximum values and 95 percent upper confidence limits on the means ($UCL_{95}$), will be compared to applicable or relevant and appropriate requirements (ARARs) in the Draft Final IM/IRA DD. If the maximum or $UCL_{95}$ is above an ARAR but the*

*mean is not, outlier testing and professional judgment will be used to determine contaminants of concern (COCs).*

**EPA June 1996**
**Human Health Risk Assessment**
**General Comments**
**Comment 1**

The adequacy of the human health assessment is dependent on open space being the future land use. The comments in this review rely on acceptance of that scenario by all parties involved. Based on that acceptance, the methods used to evaluate the human health risks are appropriate. If that scenario is not agreed on by all of the parties involved, the comments on the first draft DD should be implemented.

**Response to Comment 1**

*The accepted exposure scenarios for the various media are presented in Attachment 4 of the Rocky Flats Cleanup Agreement. Specifically:*

| *Media and Location* | *PPRG Set Used for Comparison* |
|---|---|
| *Sitewide groundwater* | *Open-space surface water* |
| *Sitewide subsurface soil* | *Construction worker subsurface soil* |
| *Industrial Area surface soil* | *Office worker soil* |
| *Buffer Zone surface soil* | *Open-space soil/sediment* |

**June 1996 EPA**
**General Comments**
**Human Health Risk Assessment**
**Comment 2**

The revised DD describes a method for identifying outliers that may be acceptable but could not be verified with the information in the revised DD.

**Response to Comment 2**

*The response to Comment 4 on J-5 of the revised Decision Document conforms to the methodology for selection of PCOCs, known as the Gilbert methodology, agreed upon by the DOE, the EPA, and the CDPHE. The method of application of professional judgment to temporally and spatially isolated results was included in the agreement and needs no further verification.*

**EPA June 1996**
**Human Health Risk Assessment-Specific**
**Comment 6**

EPA requested inclusion of exposure pathways for office workers and construction workers in the human health risk assessment. DOE refused based on the future land use of open space. If that is the agreed on future land use scenario, the response is adequate. However, if the future land use is not open space, a new risk assessment will be required using a conceptual site model for surface soils in spray evaporation areas that includes office and construction workers.

**Response to Comment 6**

*The accepted exposure scenarios for the various media are presented in Attachment 4 of the Rocky Flats Cleanup Agreement. Specifically:*

| *Media and Location* | *PPRG Set Used for Comparison* |
|---|---|
| *Sitewide groundwater* | *Open-space surface water* |
| *Sitewide subsurface soil* | *Construction worker subsurface soil* |
| *Industrial Area surface soil* | *Office worker soil* |
| *Buffer Zone surface soil* | *Open-space soil/sediment* |

**EPA June 1996**
**Human Health Risk Assessment-Specific**
**Comment 7**

The EPA commented that a conceptual site model for landfill leachate at the seep should be revised to include construction workers who may be exposed to seep water during construction of a drain. The DOE did not revise the conceptual site model to include construction workers because the workers would be following a site-specific health and safety requirements and would not be at risk. Although this rationale is acceptable, it does not completely address the original comment. Therefore, the conceptual model should be revised to include the remedial construction worker, specifying that the potential risk to the construction worker will be mitigated by following site-specific health and safety requirements.

**Response to Comment 7**

*The conceptual model presented as Figure 3-1, will be revised to include the remedial construction worker as a receptor. The supporting text in Section 3.2 will be revised to state*

*that the potential risk to the construction worker will be mitigated by following the site-specific health and safety requirements.*

**EPA June 1996**
**Human Health Risk Assessment-Specific**
**Comment 8**

The EPA commented that the DOE should adjust the soil ingestion rate for age, weight, and averaging time when estimating the exposure of the open-space users at OU 7 to radionuclides. The DOE responded that the soil ingestion rate for carcinogenic risk estimates will be age-averaged. The response did not address the soil ingestion rate formula used in determining radionuclide exposure. The formula used for determining carcinogenic intake is adjusted for age and body weight and the radionuclide intake formula is adjusted for age only. The radionuclide estimates must be calculated using intake values that reflect soil ingestion rates adjusted for age, body weight, and average timing.

**Response to Comment 8**

*Body weight and averaging time are not used in the equation for radionuclides. "One of the primary objectives of an exposure assessment is to make a reasonable estimate of the maximum exposure to individuals and critical populations groups. The equation presented in Exhibit 6-6 to calculate intake for chemicals may be considered to be applicable to exposure assessment for radionuclides, except that the body weight and averaging time terms in the denominator should be omitted." (RAGS, EPA 1989). The equations, 3-1 and 3-2, have been reviewed and were found to be incorrect. A conversion factor ($CF=10^{-6}$ kg/mg) will be added to both equations and the whole of equation 3-2 will be bracketed and divided by the averaging time (AT). The calculations were done correctly.*

**EPA June 1996**
**Ecological Risk Assessment**
**General Comments**
**Comment 1**

The DD states that the landfill pond sediments and the dam will be removed and included under the cap. The text also states that contaminated groundwater is not expected to migrate to Walnut Creek. The rationale is that the dam prevents the movement of both surface and groundwater below the landfill pond. The text continues to rely on the argument that groundwater will not move downgradient, even though the feature that apparently prevents movement will be removed and replaced with fill material. The fill material is likely to be much less consolidated than the

dam. The inconsistencies regarding groundwater movement and the likelihood of contamination moving to Walnut Creek should be reassessed and the text clarified throughout the DD.

**Response to Comment 1**

*Section 3.2, Conceptual Site Model, identifies the suspected sources, contaminant release and transport mechanisms, exposure points/affected medias, and exposure routes. This section was not intended to describe conditions after the preferred alternative is implemented. Section 3.2 will be rewritten for clarity*

**EPA June 1996**
**Ecological Risk Assessment**
**General Comments**
**Comment 2**

The text states that leachate currently enters the landfill pond containing polycyclic aromatic hydrocarbons (PAH) well above the Colorado water quality standards for those constituents. The ecological risk assessment seems to minimize the risk posed by PAHs on the aquatic community because of dilution currently provided by the landfill pond and the assertion that the seep contaminants following implementation of the IM/IRA, with consideration of changes to the hydrologic system that will result from removal of the landfill dam.

**Response to Comment 2**

*The text in section 3.3.2, Ecological Receptors, presents the results of the Tier II ecological screen. A Tier III assessment was performed and included in the August 24, 1994 draft. The results of the Tier III will be presented in section 3.3.2 and the assessment will be included again as an appendix. The results of the Tier III ecological risk assessment are further addressed in sections 4.0 and 5.0 during GRA option screening and alternative development and evaluation.*

**EPA June 1996**
**Ecological Risk Assessment**
**General Comments**
**Comment 3**

All tables should have units clearly identified. Units used in the text should be consistent with those in tables. For example, text usually discusses concentrations in water as micrograms per liter (μg/L). The tables, however, provide data in milligrams per liter (mg/L). It also appears that conversions from micrograms to milligrams were sometimes incorrect. All numbers in all tables should be verified.

**Response to Comment 3**

*The units in the text and tables will be made consistent. The units in Tables 3-1, 3-2 and 3-15 will be corrected.*

**EPA 1996**
**Ecological Risk Assessment**
**General Comments**
**Comment 4**

The DD refers frequently to mitigation for the loss of wetlands that will result from the implementation of the IM/IRA. No details of that mitigation are provided, however. The issue appears to rely on a yet-to-be-signed memorandum of agreement, apparently between DOE, EPA, the U.S. Army Corps of Engineers, and the state of Colorado. The text should identify options available for mitigation and those recommended for the IM/IRA.

**Response to Comment 4**

*The Memorandum of Agreement has been approved and signed by DOE, EPA, COE and USFWS. The text in sections 8.1.7, 9.2.1,7.2.2, 6.2.2, 6.2.3 and 6.2.4. will be revised to reflect the approval.*

**EPA June 1996**
**Ecological Risk Assessment**
**Specific Comment**
**Comment 1**

Page 3-5, Paragraph 5. The text suggests that a seep is always an intermittent aquatic community. The rationale for this assumption is not clear. Many seeps, including the seep into the landfill pond, have continuous flow throughout the year, which makes the seep a perennial water body. The aquatic community found in the seep should reflect the year-round nature of the water supply. The text should be revised.

**Response to Comment 1**

*Historical sampling data indicates that the OU 7 seep is dry periodically The sentence has been changed to state that an intermittent aquatic community, such as the landfill pond seep, is not likely to provide adequate habitat for establishment of permanent aquatic communities.*

**EPA June 1996**
**Ecological Risk Assessment**
**Specific Comments**
**Comment 2**

Page 3-6, Paragraph 1. The text states that the "Clean Water Act's AWQC (ambient water quality criteria) chose not to set barium standards for aquatic organisms. Soluble and toxic forms of barium in freshwater or marine ecosystems were thought unlikely due to the physical and chemical properties of barium. Therefore, EPA chose not to set freshwater or marine AWQC." A citation should be provided for these statements. It is generally EPA's position to not test water quality standards for chemicals where insufficient data are available. A determination that barium does not create a toxicity problem would be more likely to be reflected in a high AWQC rather than no criterion. The lack of a standard does not indicate a lack of risk.

**Response to Comment 2**

*The statement concerning barium will be removed from the text in Section 3.3.2 if a citation is not found.*

**EPA June 1996**
**Ecological Risk Assessment**
**Specific Comments**
**Comment 3**

Page 3-31, Table 3-15. Table 3-15 appears to compare contaminant concentration in groundwater with surface water quality standards to assess ecological risk in the event that water reached the surface in a spring or seep. The water quality standards listed for lead, methylene chloride, tetrachloroethene, and trichloroethene appear to be too high by factors of a million to 10 million. The source of the numeric values for those constituents is not clear, although a footnote identifies the source as Colorado water quality standards. The numbers differ from those listed by Colorado for the Walnut Creek drainage. Table 3-15 does not provide a standard for nitrate/nitrite, although criteria exist for nitrate and nitrite individually, at considerable lower concentration than the maximum detected in the groundwater. The table should be corrected.

**Response to Comment 3**

*As EPA and CDPHE were informed by telephone calls, the units for Table 3-15 were incorrectly stated as mg/L; the correct units are* µg/L. *The text will be changed to correct the error.*

*The numeric values (exposure parameters) for ecological receptors are described in Technical Memorandum No. 2--Sitewide Conceptual Model (TM2) and a methodology for screening chemicals for ecotoxicity is taken from Technical Memorandum No. 3--Ecological Chemicals of Concern.*

*The criteria that exist for nitrite and nitrate are not aquatic life based and therefore not used for ecological assessment.*

**EPA June 1996**
**Ecological Risk assessment**
**Specific Comments**
**Comment 4**

Page 3-40, Table 3-19. The table purports to show the analytes for which surface water applicable or relevant and appropriate requirements (ARAR's) were exceeded at the seep. This list of analytes does not agree with the text on page 2-21, which shows other constituents at concentrations exceeding ARARs, or the Colorado water quality standards for PAHs. The text and tables should be reviewed and the consistency of the information provided evaluated. The table and text should be revised where necessary.

**Response to Comment 4**

*The text on page 2-21 lists the Contaminants of Concern (COCs) at Operable Unit Seven. The COCs list was determined by several statistical measurements. Table 3-19 presents those COCs that exceed ARARs. The text and tables are consistent.*

**EPA June 1996**
**Ecological Risk Assessment**
**Specific Comments**
**Comment 5**

Page 9-5, Paragraph 3. The text in this paragraph is inconsistent in its discussion of establishment of woody vegetation on the remediated areas. It states that measures will be taken to prevent woody species from establishing on the cap area. It also states that woody species may take 10 years to become established. It is not clear whether the same areas are being discussed. The text should be clarified regarding the expectations surrounding revegetation of the remediated area.

**Response to Comment 5**

*The text will be clarified regarding revegetation of the remediated area.*

**EPA March 1996**
**Comment 1, Page J-1**
**Risk Assessment**

Methodologies to evaluate both human health and ecological risks are unacceptable. Several complete exposure pathways were not considered in the human health risk assessment in the OU 7 DD. In addition, many human health risk assessment methods do not conform to EPA guidance (EPA 1989, 1991a). In particular, the use of invalidated data and comparison of mean chemical concentrations to applicable or relevant and appropriate requirements (ARARs). Unless these deficiencies are corrected, risk to human receptors may be significantly underestimated. The conclusion that there is no risk to wildlife at the East Landfill Pond surface water and sediments was arbitrary in that it contradicted the results of the focused risk assessment for these media, and it was based on incorrect water quality standards.

**March 1996 Response to Comment 1, Page J-1**

*For the revised document, human health risks have been evaluated only for the open-space exposure scenario because this is the anticipated future land use for the area surrounding the landfill as recommended by the Future Land-Use Working Group (DOE 1995). Exposure pathways for occupational scenarios are incomplete because industrial development at OU 7 will not be possible due to land-use restrictions (deed restrictions and/or state orders) after construction of the landfill cap. The ecological worker scenario was not evaluated because the open-space scenario is more conservative.*

*Risks will be recalculated using validated data only (i.e., eliminating 1990 data). Mean chemical concentrations, as well as maximum values and 95 percent upper confidence limits on the means (UCL95), will be compared to applicable or relevant and appropriate requirements (ARARs) in the Draft Final IM/IRA DD. If the maximum or UCL95 is above an ARAR but the mean is not, outlier testing and professional judgment will be used to determine contaminants of concern (COCs).*

**June 1996 EPA**
**Refers to Comment 1, Page J-1**
**Response to EPA Comments**
**Executive Summary**
**Comment 1**

The response [to comment 1, Page J-1] does not address the ecological risk assessment issues of the comment.

## Response to Comment 1

*The ecological risk assessment was performed following the ecological risk assessment methodology (ERAM) that has been developed to support risk management decision at Rocky Flats. The ERAM is documented in a series of Technical Memoranda (TMs) that are subject to review and approval by EPA and CDPHE. The methodology focuses primarily on evaluating the effects of potential chemicals of concern (PCOCs) and includes a process for conducting a screening-level exposure analysis and risk characterization for site-specific receptors. Assumptions about life history and exposure parameters for ecological receptors are described in Technical Memorandum No. 2—Sitewide Conceptual Model (TM2) a, methodology for screening chemicals for ecotoxicity is taken from Technical Memorandum No. 3—Ecological Chemicals of Concern (ECOCs) Screening Methodology (TM3).*

*The initial phases of the ERAM corresponds to elements of EPA's' eight-step (draft) guidance on documenting ERAs at Superfund sites (EPA 1994). The first two steps of EPA's process, Preliminary Project Formulation and Ecological Effects Characterization (Step 1) and Preliminary exposure Estimate and Risk Calculation (Step 2), are intended to allow risk assessors and managers to rapidly determine whether a site poses an ecological risk. Subsequent steps (Tier III) of the EPA methodology are performed if potential risks are identified These steps are more detailed and are aimed a refinement or risk estimates and attaining site-specific cleanup goals.*

*Tier III results indicate a risk to raccoons (HI 2.53) mallards (52.73), and coyotes (2.95). The risk assessment assumes that the raccoons, mallards and coyotes will feed exclusively in the East landfill seep. This is unlikely since the East Landfill seep comprises less that 1% of seeps at RFETS. In addition, the seep will not support an aquatic community of crayfish and fish and therefore will be of limited value as a foraging resource for raccoons. Mallards prefer open water habitat and coyotes are far ranging.*

*This level of risk estimation is adequate for threatened/endangered or other sensitive species for which protection of individual organisms is desire. However, protection of populations is more appropriate for species that are not protected or rare (Barnthouse 1993). The is no unacceptable risk the Preble's Meadow Jumping Mouse.*

**EPA March 1996**
**Comment 2, Page J-2**
**Groundwater/Leachate Control**

The OU 7 DD does not discuss where leachate will discharge after construction of the cap and whether it will continue to be treated. A project is currently underway to install a passive seep collection and treatment system. The treatment system will be dismantled prior to cap construction. The document asserts that capping the landfill will cover the landfill seep (where leachate that has been identified as Resource Conservation and Recovery Act [RCRA]-listed F039 waste discharges) thus eliminating exposure to the seep. The document states that a gravel blanket or French drain beneath the general fill layer will prevent the leachate from building up and creating a new seep. However, the OU 7 DD does not specify where the new discharge point will be located. Instead, the document emphasizes that the landfill cap and slurry wall will diminish flow into the landfill to the point where the seep will eventually dry up. Groundwater modeling results provided with the document suggest that leachate will continue to discharge in excess of 1 gallon per minute (gpm) for approximately 5 years after the cap is constructed and will be flowing at a rate of 0.4 gpm 24 years after the cap is constructed.

**March 1996 Response to Comment 2, Page J-2**

*The revised Interim Measure/Interim Remedial Action Decision Document evaluated several groundwater/leachate control alternatives that underwent a detailed analysis consisted of: (1) natural attenuation and seep water discharge to groundwater, (2) slurry wall with seep water discharge to groundwater, and (3) engineered wetlands will seep water discharge to surface water.*

*From the detailed analysis and the comparative analysis, the preferred option for groundwater/leachate control is natural attenuation and seep water discharge to groundwater. The existing seep area would be covered with fill and included inside the area of the capped landfill. A gravel drainage layer will be constructed under the cap from the seep downgradient to the east just past the extent of the cap. This will allow leachate at the seep to drain and discharge to the fill down the valley. The East Landfill Pond will be filled with up to 20 feet of engineered will that will serve as a conduit for seep water to percolate to groundwater. The engineered fill will generally consist of granular fill with a permeability of approximately of 1 x 10-2 cm/sec. The fill can be augmented with organic material such as peat, to promote natural attenuation.*

**EPA June 1996**
**Refers to Comment 2, Page J-2**
**Responses to EPA Comments**

**Comment 2**

The response identifies the preferred option for groundwater/leachate control to be natural attenuation. This option does not appear to be adequately supported in the revised DD, however. The revised DD assumes contaminated groundwater currently discharging from the seep will drain through fill material for eventual discharge down the valley with an attenuated contaminant load. The text also states, inconsistently, that groundwater will not move downgradient much beyond the current landfill pond and will not surface for potential discharge to Walnut Creek. These statements appear to contradict each other and the text and comment response should be clarified.

**Response to Comment 2**

*The statement that groundwater migration beyond the current landfill pond in section 3.2 of the conceptual site model was not intended to reflect conditions after the preferred alternative is implemented. The conceptual site model was used to identify source areas, transport/release mechanisms, exposed media, and receptors.*

*The groundwater/leachate control alternatives will be reevaluated once the RFCA implementation document is approved and comment #28 (CDPHE August 1996) is resolved.*

**EPA March 1996**
**Comment 1 Page J-7**
**Ecological risk Assessment**

The ecological risk assessment repeatedly states that the existing seep will be covered by the presumptive remedy and therefrom, will not be a point of exposure to contaminants for ecological receptors in the future. It is not clear, however, where leachate that currently is released at the seep will go. It appears that it may be collected by a drain system and discharged to the East Landfill Pond. If this is not the case, it is not clear how this would reduce the likelihood of an organisms exposure to the contaminants. Although the volume of leachate discharged from the landfill is expected to attenuate over time, initial discharges would probably be similar to current volumes, but to a smaller receiving body. Conditions at the discharge point would therefore be expected to be similar to the current situation and overall pond water quality would be expected to be worse. The OU 7 DD should evaluate the effects of movement of the leachate discharge point rather than assuming burial of the seep will eliminate leachate discharge. Ecological risk should be reassessed and all discussions related to discharges of seep and pond waters should be reassessed.

**March 1996 Response to Comment 1 Page J-7**

*As described in the response to comment 2 of the Executive Summary, the preferred alternative for groundwater/leachate control is natural attenuation and seep water discharge to groundwater. Extensive modeling has been conducted that demonstrates that seep water will not surface and no new ARARs will be exceeded at the Point of Compliance during the 30 year postclosure care period. Currently, alluvial aquifer concentrations of iron, chromium and lead exceed ARARs. Dissolved chromium and total recoverable lead exhibited one exceedance of the corresponding ARARs. The standards are based on acute and chronic criteria for aquatic life. In addition, the mean values of iron are less than the mean for background, and the maximum values are also less than the background maximum.*

**EPA 1996**
**Responses to EPA Comments**
**Ecological Risk Assessment**
**Refers to Comment 1, Page J-7**
**Comment 1**

The response does not agree with the information provided in the revised DD. This list of constituents with concentration exceeding ARARs is not the same as that provided in the text and in tables. The response also appears to differ from the response to comment 2 on the executive summary by saying the seep water will not surface. In addition, the response states that no new ARARs will be exceeded at the point of compliance during the 30-years post-closure care period." The National Contingency Plan requires all ARARs to be met and does not distinguish between old and new. The plan to ignore treatment of groundwater contamination should be reevaluated.

**Response to Comment 1**

*The text on page 2-21 lists the Contaminants of concern (COCs) at Operable Unit Seven. The list was determined by several statistical measurements. Table 3-19 presents those COCs that exceed ARARs, The text and table are consistent.*

*Supporting text will be added to the document to support ARAR waivers, as appropriate, once the RFCA implementation document is approved and comment #28 (CDPHE, August 1996) is resolved.*

**EPA March 1996**
**Ecological Risk Assessment**
**Comment 6, Page J-8**

Throughout the OU 7 DD, the need to mitigate the loss of wetlands during the construction of the landfill is identified, with the potential for use of wetlands banked during construction of the Standley Lake diversion project to compensate for the lost wetlands. It is not clear that wetlands will be created beyond those required to mitigate wetland losses from construction of that project. More specificity should be provided regarding the potential loss of wetlands during construction of the landfill cap.

**March 1996 Response to Comment 6, Page J-8**

*Mitigation of the OU 7 wetlands is included in the "Memorandum of Agreement for the Administration of a Wetlands Bank at Rocky Flats" (DOE 1995), which has been approved by EPA and is presently being reviewed by COE and USFW.*

**EPA June 1996**
**Responses to EPA Comments**
**Ecological Risk Assessment**
**Comment 6**

The response does not provide any information regarding mitigation for the loss of OU 7 wetlands, other than to say it is included in the Memorandum of Agreement for establishment of a wetland bank.

**Response to Comment 6**

*The Memorandum of Agreement has been approved and signed by DOE, EPA, COE and USFWS. The text in sections 8.1.7, 9.2.1, 7.2.2, 6.2.2, 6.2.3, and 6.2.4 will be revised to reflect the approval.*

**EPA March 1996**
**Comment 7, Page J-9**
**Risk Assessment**

Much of the ecological risk assessment is based on incorrect water quality standards and the assumption that covering the seep will eliminate the release of leachate. These factors underestimate the ecological risk associated with OU 7. Ecological risk should be reassessed for all media, receptors, and PCOCs.

**March 1996 Response to Comment 7 Page, J-9**

*Only correct state water quality standards will be used in the revised document. Stream segment-specific state water quality standards for radionuclides were developed for protection of human health and are not applicable to aquatic life. Therefore, benchmarks developed specifically for RFETS by scientists at Argonne National Laboratory and Oregon State University were used to evaluate the potential for toxic exposure of aquatic life.*

**EPA June 1996**
**Responses to EPA Comments**
**Executive Summary**
**Refers to Comment 7, Page J-9**
**Comment 7**

It appears that incorrect water quality standards are still used in the revised DD.

**Response to Comment 7**

*The water quality standards were verified in Technical Memorandum No. 2—Sitewide Conceptual Model and Technical Memorandum No. 3—Ecological Chemicals of Concern (ECOCs) Screening Methodology.*

**EPA June 1996**
**Landfill Design**
**Comment 1**

Water-balance equations are reported to predict that 60 percent of groundwater inflow will be cut off by capping the landfill (Section 2.3.6, page 2-15, paragraph 1). Not all the flow witnessed at the seep, however, is attributable to inflow as evidenced by the difference in flow seen at the seep while adjacent alluvial well 0786 was dry. (Section 2.3.3, page 2-11, paragraph 3). As decomposition continues within the present landfill, leachate will also continue to be generated. This, perhaps, accounts for some of the flow present at the seep when alluvial well 0786 is dry. If Hydrologic Evaluation of Landfill Performance (HELP) and other groundwater models predict a continuation of flow, eventual attenuation of seep flow should be explained when the presence of peat and manure in the unconsolidated engineered fill will not decrease wither the volume or rate of inflow and leachate.

**Response to Landfill Design Comment 1**

*The groundwater/leachate control options will be reevaluated once the RFCA implementation document is approved and comment #28 (CDPHE, August 1996) is resolved.*

**EPA June 1996**
**Landfill Design**
**Comment 2**

The presumptive remedy for landfills containing primarily municipal waste includes leachate collection and treatment as a component of source containment (EPA 1993). The selected alternative which envisions leachate percolating into groundwater is not treatment. The addition of peat and manure to a granular fill a describe in Sect 5.4.4 of the document will address treatment of a small number of the hazardous substances found in the leachate, but not the more serious contamination components. For reasons discussed in the specific comments, information is required to explain how leachate will discharge to groundwater or if it will join surface waters. If leachate joins surface water, the groundwater contaminant transport simulations do not adequately describe the movement of the various contaminants to the point of compliance.

**Response to Comment 2**

*In the presumptive remedy publication referenced, 'leachate collection and treatment' is an* ***optional*** *[emphasis added] component of the presumptive remedy.*

*Groundwater/Leachate collection and treatment alternatives will be reevaluated once the RFCA implementation document is approved and a consensus is reached concerning leachate management (Comment #28 CDPHE, June 1996). Groundwater/Leachate collection and treatment alternatives will also take into consideration concerns stated regarding contaminant migration pathways.*

**EPA June 1996**
**Landfill Design**
**Comment 3**

There is an inconsistency with regard to the East Landfill Pond and dam. While the text states that the pond will be drained and the dam removed, data input for both the groundwater flow and contaminant transport models use a boundary coincident with the dam. If the dam were to remain and the pond filled with the proposed gravel mixture, some outlet structure would be needed to relieve the inevitable build up of stormwater, groundwater, and leachate within the gravel in a controlled manner. Otherwise, there is nothing in the design to prevent the gravel filled pond from becoming saturated and overflowing the dam. Any overflow would be a release to surface water, which should be treated under the presumptive remedy. The document should be revised to address the effectiveness of alternatives which would impound the seep within the gravel fill behind the dam.

**Response to Landfill Design, Comment 3**

*The dam will be removed or breached. The contaminant transport models do not include a low permeability boundary coincident with the dam.*

**EPA June 1996**
**Groundwater Modeling**
**Comment 1**

A few problems with the groundwater and contaminant transport models are discussed in a general nature within specific comments on development and analysis of the remedy alternatives. Specific comments on each of the models are also included in Section 3 of this report. Revisions to the models are necessary to support conclusions drawn and decisions made with respect to ARAR compliance and the landfill cap performance.

**Comment 1**

*This general comment is addressed in the responses to specific comments that follow.*

**EPA June 1996**
**ARARS**
**Comment 1**

Statements that ARARs are met are not supported by the documentation. Specific comments require some revision to the documentation and will also require revision to discussions regarding ARAR compliance.

**Response to Comment 1**

*The groundwater/leachate control options will be reevaluated once the RFCA implementation document is approved and comment #28 (CDPHE, August 1996) is resolved. ARARs will be evaluated and updated as appropriate.*

**EPA June 1996**
**Specific Comment 1**

Page 5-15, Section 5.2.1., Paragraph 6. The 12-inch low-permeability soil layer of Option E can not be directly compared with the 24-inch clay layer of Option G because of their disparate thickness. The section stresses that the low-permeability soil layer is preferable over clay because gradation, moisture content, and compaction requirements are less rigid then those for a

clay layer, but on page J-10, Section J.2.3, the response to comment 1 stresses that a low-permeability soil is more water tight than clay. This latter statement, attributed to unnamed researchers, is not supported by a citation nor is not supported by HELP model results. Further, EPA guidance (1989) recommends 60 cm, about 24 inches, of a low-permeability soil layer below a flexible membrane cover for final covers over landfills containing hazardous waste. The EPA guidance definition of a low-permeability soil, however, is one meeting 1.00 E-7 centimeters per second (cm/sec) not 1.00 E-5 cm/sec.

As supported by the borehole geologic logs in Appendix A and Figure 2-8 plotting hydraulic conductivity for each geologic unit on OU 7, soil meeting a maximum 1.00 E-5 cm/sec.

As supported by the borehole geologic logs in Appendix A and Figure 2-8 plotting hydraulic conductivity for each geologic unit on OU 7, soil meeting a maximum 1.00 E-5 cm/sec permeability requirement is essentially the regular dirt found on site. Since the low permeability soil layer is intended to act as a barrier, it should provide more of an infiltration retardance than the onsite soil likely used as daily cover by landfill operations.

Continuing in this vein, the Colorado Hazardous Waste Act (CHWA) requires that a landfill have permeability less than the natural subsoil or bottom liner (6 CCR 1007-3 Part 265.310). Support documentation indicates that the weathered bedrock under this landfill has a permeability of 1.00 E-7 cm/sec. The low permeability soil as a barrier layer is not, therefore, less permeable than the natural substratum.

### Response to Specific Comment 1

*The low permeability soil cover option will be removed from the analysis. The remaining cover options, combined with new technologies as they develop, will be reevaluated once the RFCA Implementation Document is approved.*

### EPA June 1996
### Specific Comment 2

Page 5-5, Section 5.2.1, Paragraph 4 and Page 5-30, Table 5-1. The text on page 5-5, paragraph 4 states that a native seed mixture for the vegetation cover will be selected by a site ecologist. Table 5-1, however, calls for only tall-prairie grasses. There is no documentation to support a conclusion that tall-prairie grasses will provide an adequate stabilized vegetative cover or if prairie grasses are native to northern Jefferson County, Colorado. A survey of the native vegetation must be taken of the area during the early phases of design and, from the survey, a seed mixture selected which will provide diverse vegetation with sufficient cover, moisture

retention, and erosion control to meet soil conservation requirements while requiring little maintenance.

### Response to Specific Comment 2

*A survey of the native vegetation was performed and reviewed by the Site Ecologist. Table 5-1 is the recommended seed mix.*

### EPA June 1996
### Specific Comment 3

Page 5-27, Section 5.4.4 Paragraph 1 and Figures 5-2, 5-2a, and 5-2b. The description for discharge of leachate to groundwater does not sufficiently clarify what mechanism will prevent leachate bubbling through the gravel/manure fill mixture from eroding a surface channel once the East Landfill Pond embankment is removed. Even if the leachate escapes the fill by seeping into weathered bedrock (Section 2.3.2, page 2-10, paragraph 1), the natural ground slope indicates perched groundwater could resurface farther downstream.

### Response to Specific Comment 3

*The groundwater/leachate control options will be reevaluated once the RFCA Implementation document is approved and comment #28 (CDPHE, August 1996) is resolved.*

### EPA June 1996
### Specific Comment 4

Page 5-27, Section 5.4.4, Paragraph 2. The contaminant transport model inputs do not sufficiently correspond to a discharge to groundwater scenario. For this reason, the statement that "leachate contaminant concentrations are greatly attenuated and generally meet ARARs" at the point of compliance is not supported.

### Response to Specific Comment 4

*The contaminant transport model inputs correspond to migration of contaminants through the valley fill alluvium.*

### EPA June 1996
### Specific Comment 5

Page 5-27, Section 5.4.4, Paragraph 2. The gravel/manure fill mixture should operate similar to an anaerobic wetland in its ability to reduce metal contaminants. The mix would be improved by adding sulfate reducing bacteria (SRB) similar to the system described in Section 5.4.3, beginning pages 5-24, "Engineered Wetlands". The appropriateness of adding SRBs and whether periodic maintenance would require replacement of the manure or SRB should be addressed.

### Response to Specific Comment 5

*No response required.*

### EPA June 1996
### Specific Comment 6

Page 6-7, Section 6.2.2, Paragraph 4. The statement that "Leachate treatment will not be needed because ARARs will be met at the point of compliance" for seep water discharge to groundwater does not agree with the evaluation of discharge to groundwater in Section 5.4.4, page 5-27, paragraph 2. Section 5.4.4 states that ARARs are "generally" met. The contaminant transport model as run predicts that iron concentrations will not meet ARAR limits at the point of compliance. Further, the model input parameters do not reflect the material through which contaminated leachate will travel and, therefore, predicted results for manganese, ammonia, and all the organic contaminants are questionable. No justification for an ARAR waiver has been provided within the analysis. The text should be corrected.

### Response to Specific Comment 6

*The contaminant transport model inputs will be reevaluated to determine if they are appropriate. Models will be rerun, as appropriate*

### EPA June 1996
### Specific Comment 7

Page 6-7, Section 6.2.2, Paragraph 4. There is no support in the report that the surface water pathway will truly be eliminated. If the East Landfill Pond dam is removed, it is much more reasonable that leachate seeping from under the landfill cap through the high permeability unconsolidated engineered fill will continue a lateral path and daylight into No Name Gulch rather than percolate into the low permeability alluvial fill. Leachate will likely continue untreated into Walnut Creek exposing fish, animals and humans to the contaminants carried along. The design, as such, does not offer much protection for human health and the environment nor meet all of the remedial action objectives. As evaluated, levels of some

contaminants will be exceeded. Even though ARARs exceedances are not excessive, any exceedance is significant. The design should be reassessed.

### Response to Specific Comment 7

*Leachate may daylight in the No Name drainage during high precipitation events (December-May), although unlikely. Leachate is not a threat to human health or potential sensitive or threatened and endangered species. Leachate may pose a threat to individuals of population of species that are not threatened or endangered. The groundwater/leachate control options will be reevaluated once the RFCA Implementation document is approved and comment #28 (CDPHE, August 1996) is resolved.*

### EPA June 1996
### Specific Comment 8

Page 6-8, Section 6.2.2, Paragraph 1 and Page 6-9, Paragraph 3. See the two preceding comments [comment 6 and comment 7, June 1996].

### Response to Specific Comment 8

*See the preceding two responses. The text will be revised as appropriate.*

### EPA June 1995
### Specific Comment 9

Page 6-10, Section 6.2.2, Paragraph 4. It is not reasonable to place the low permeability soil layer in a single 12-inch lift, as described in the text. To insure a proper 95 percent compaction, the layer should be placed in two 6-inch lifts.

### Response to Specific Comment 9

*Although a low permeability soil alternative will meet the closure requirements, it will not be used in the cover systems evaluated in the next revision of the Decision Document.*

### EPA 1996
### Specific Comment 10

Page 6-17, Section 6.3.1, Paragraph 1. If by placing a cap over the landfill, the 2 gallons per minute (gpm) total flow will be decreased by half (2 gpm - 1/2(2 gpm) = 1 gpm) and construction of a slurry wall is predicted to further decrease total flow by 1 gpm (1 gpm - 1 gpm = 0 gpm), it seems coupling a slurry wall with the landfill cap would essentially eliminate

groundwater flow through the landfill contaminants. The statement that "the slurry wall decreases groundwater flow by only an additional 1 gpm" (emphasis added) should be clarified. Considering that some treatment of leachate may be required to meet ARARs after the contaminant transport model is rerun, the benefit of a slurry wall for reducing the volume and rate of leachate production may outweigh the cost of constructing it.

### Response to Specific Comment 10

*Groundwater/leachate control options will be reevaluated once the RFCA Implementation document is approved and comment #28 (CDPHE, August 1996) is resolved.*

### EPA June 1996
### Specific Comment 11

Page 7-3, Section 7.2.1, Last Paragraph. See comments above related to conclusions concerning discharge of seep water to groundwater, results of the contaminant transport simulation, and whether ARARs will be met at the point of compliance.

### Response to Specific Comment 11

*See response to above comments.*

### EPA June 1996
### Specific Comment 12

Page C-3, Section C.5.a, Paragraph 1. Figure 7-3A, a section cut through the proposed landfill cover, indicates that the East Landfill Pond dam will be removed. If the dam is to be removed, it seems that the groundwater model for the "cap only" and the "cap and north slurry wall" scenarios should not use low hydraulic conductivity cells to define the boundary where the dam currently exists.

### Response to Specific Comment 12

*The model does not use low hydraulic conductivity cell to define the boundary where the dam currently exists. (Please see Appendix D of the document).*

### PEA June 1996
### Specific Comment 13

Page D-6, Section D.3.3. The hydraulic conductivity selected for contaminant transport modeling uses a value representative for the valley fill alluvium of 7.3 feet per day (ft/day) or 2.6 E-3 cm/sec. An appropriate value, however, would be 28.3 ft/day or 2.00 E-2 cm/sec which corresponds to the unconsolidated "engineered fill" selected for placement above weathered bedrock in place of East Landfill Pond. More than 70 percent of the distance between well 0786 and the point of compliance, well 4087 will be this engineered fill under the selected corrective action. The model should be rerun using a revised seepage velocity.

### Response to Specific Comment 13

*The groundwater/leachate control options will be reevaluated once the RFCA implementation document is approved and comment #28 (CDPHE, August 1996) is resolved. Models will be rerun as appropriate.*

### EPA June 1996
### Specific Comment 14

Page F-4, Section F.1.2, Last Paragraph and Table F-1. It is not a reasonable assumption that soil present on site and intended to be used for the 1.00-5 cm/sec low-permeability barrier soil layer has the same porosity, field capacity, and wilting point as a 1.00-7 cm/sec clay brought in from offsite. According to the boring logs in Appendix A, the majority of soil suitable for the low-permeability layer are Type CL (Borings 52694, 52894, and 53794). Values used for the low permeability barrier soil layer field capacity and wilting point are too high. The model should be revised and rerun for Alternative 7 to reflect the landfill cover being evaluated as Option E.

### Response to Specific Comment 14

*A low permeability soil will not be used or evaluated as a cover component.*

### EPA June 1996
### Specific Comment 15

Page F-3, Section F.1.2, Paragraph 4. The value for manufacturer defects in the flexible membrane liner material, related as a number of flaws per acre (flaw/acre), as recommended by the HELP Model User's Guide is misstated. A table in Section 3.6 on page 34 of the User's Guide recommends a pinhole deflect density of 1 to 4 for a "good" installation quality. The last sentence of the first full paragraph of page 34 further recommends that "reasonably conservative estimates of the defect densities should be specified to determine the maximum probable leakage quantities" (Emphasis added). These recommended defect density numbers are supported by

research by Giroud and Bonaparte, cited in the HELP Model Engineering Documentation in Section 4.16.1, page 78, first paragraph. To quote, "Giroud and Bonaparte (1989) recommend using a flaw density of 1 flaw/acre for intensively monitored projects. A flaw density of 10 flaws/acre or more is possible when quality assurance is limited to spot checks or when environmental difficulties are encountered during construction."

A "good" installation quality is reasonable for the model runs. The selection of 0.5 flaw/acre is neither conservative nor representative of defect frequency encountered by researchers. The model should be rerun for Alternatives 5, 7, and 9 using a minimum of 1 flaw/acre and the evaluation of these alternatives and their associated Section 5 screening should be revised accordingly. If 1 flaw/acre is used in the model and to ensure such a value is representative, the design specifications regarding quality control and inspect of the flexible membrane liner manufacture and placement should be rigorous.

**Response to Comment 15**

*The HELP model will be rerun using a flaw rate of 1 flaw/acre.*

**EPA Comment June 1996**
**Human Health Risk Assessment**
**Comment 1**

Page 3-6, Section 3.3.3, 2nd paragraph The last sentence states that EPA guidance says that dermal exposure to meals and radioncuclides should not be quantified. This is incorrect and should be removed from the text. It would, however, be appropriate to state that dermal exposure to metals in soils is considered to be negligible in comparison to exposure via other pathways, and is generally addressed qualitatively rather than quantitatively in Region 8.

**Response to Comment 1**

*The statement will be revised as recommended.*

**EPA June 1996**
**Human Health Risk Assessment**
**Comment 2**

Page 3-8, 1st paragraph and Table 3-4 A matrix factor of 0.5 is used for the bioavailability of arsenic from soil. This is inappropriate and should be removed from the text. Also, the risk calculation for arsenic should be redone using a matrix effect of 1. Page 3-8 cites the 1993 Freeman study as the basis for the 0.5 matrix variable. The Freeman study was conducted on

smelter-derived copper, zinc, and iron-arsenic oxide in a cemented matrix (arsenic surrounded by an insoluble matrix). DOE was provided with a copy of EPA's Clark Fork River Guidance which discussed a number of arsenic bioavailability studies which exhibited widely disparate results depending on the form of arsenic present. The guidance specifically recommends that changes in bioavailability **not** be made without either the condition of a site-specific bioavailability study and/or the collection of geochemical speculation data. None of this data was ever collected at Rocky Flats. It is wholly inappropriate to pick a bioavailability adjustment factor without the scientific basis for doing so. It should also be noted that EPA and CDPHE recently sent a joint letter to DOE specifically stating that risk assessments which used soil matrix factors without the prior consent of both EPA and CDPHE would be rejected.

### Response to Comment 2

*Risk will be recalculated using a matrix factor of 1.*

### EPA June 1996
### Human Health Risk Assessment
### Comment 2

Page 3-18, last paragraph The third sentence states that iron is a nontoxic constituent. This is absolutely incorrect and should be revised. Dose makes the poison. Acute effects associated with ingestion of elevated doses or iron include vomiting, ulceration of the GI tract, renal and hepatic renal, and death. Chronic exposure is associated with blood disorders, abnormal liver function, endocrine and cardiovascular effects. it would be more appropriate to state that the concentrations of iron present would notice an unacceptable risk to humans. Region 8 uses 0.26 mg/kg/day as the screening toxicity value (much like a RfD) for iron based on the US RDA.

### Response to Comment 3

*The statement will be revised as suggested.*

### EPA June 1996
### Risk Assessment
### Comment 4

Page 3-22, Table 3-3 and page 3-30, Table 3-14 The toxicity value for nitrate (nitrate is an order of magnitude less toxic than nitrite) was used to develop the risk-based remediation goal for nitrate) was used to develop the risk-based remediation goal for nitrite and nitrate. Although analytical labs have the capability to analyze for nitrates and nitrates separately, Rocky Flats chose not to do so. Either evidence should be provided which substantiates that nitrate is the

dominant form present in soil, or the remediation goal should be based on nitrate to be prudent in the face of a significant data gap.

**Response to Comment 4**

*Risk will be calculated assuming nitrite is the dominant species.*

**EPA June 1996**
**Human Health Risk Assessment**
**Comment 5**

Page 3-24, Table 3-7 The oral slope factor for arsenic on IRIS is now 1.5, not 1.75.

**Response to Comment 5**

*The oral slope factor will be corrected and the risk assessment rerun.*

**EPA June 1996**
**ES-1**

1stP, last sentence: "..., including implementing a leachate collection and treatment accelerated action, disposing of investigation-derived..."

**Response to ES-1**

*The sentence will be revised.*

**EPA June 1996**
**ES-1**

4th P, 1st sentence: For clarification "remaining pathways, including 1) surface and ...areas, 2) landfill leachate..., and 3) groundwater...assessment process.
Comment 4 (June 1996)

**Response to ES-1**

*The sentence will be revised.*

**EPA June 1996**
**1-4**

Section 1.3.3: Please specify which wells will be abandoned. This-section says 26/54 will be abandoned but Fig. 8-1 shows only 12 wells remaining during closure. What will happen to the other 16 wells?

**Response to 1-4**

*The remaining 16 wells will revert to the Sitewide Groundwater Monitoring Program for evaluation.*

**EPA June 1996**
**Comment 2-1**

4th P- Wouldn't it be more accurate to indicate that there is some chance the new landfill will not open or that the timing is somewhat uncertain.

**Response to Comment 2-1**

*The document will be revised to reflect any timeline uncertainties.*

**EPA June 1996**
**Comment 2-13**

4th P, next-to-last sentence: "phenomena" to "phenomenon"

**Response to Comment 2-13**

*The sentence will be changed as recommended.*

**EPA June 1996**
**Comment 2-15**

1stP, section 2.3.6, 2nd sentence: What indications do you have that No Name Gulch will continue to be a losing stream once the dam is removed and the leachate flows downgradient?

**Response to Comment 2-15**

*Observations and inference from modeling of the Woman Creek drainage indicate that No Name Gulch would continue to be a losing stream.*

**EPA June 1996**

**Comment 2-27+**

It would be helpful somewhere in the document if you could specify the isomer of the compound e.g. is the trichloroethane detected in the UHSU GW 1,1,2 or 1,1,1?

**Response to Comment 2-17+**

*RFEDS will be searched to determine if the isomer can be specified.*

**EPA June 1996**
**Comment 2-49**

Was no Cd detected in the LHSU GW?

**Response to Comment 2-49**

*RFEDS will be searched to determine if cadmium was detected in the LHSU.*

**EPA June 1996**
**Figure 2-9 and 2-10**

These two figures indicate very little information on groundwater movement with the exception of aproximately 300' within the OU. Although it appears like that all of the groundwater flow into No Name Gulch this cannot be concluded from the information given. DOE either needs to install additional piezometers to confirm the GW gradient or it should add at least 2 more wells to its post-closure monitoring plan (roughly to the northeast and southeast of OU 7) to monitor GW movement in the future. The minimum number of wells, 1 upgradient and 3 downgradient, is not sufficient to answer post closure concerns at this OU.

**Response to comment Figure 2-9 and 2-10**

*The Sitewide Groundwater Monitoring Program will review the adequacy of groundwater information in proximity to OU 7 and results will be reported in the next revision of the Decision Document.*

**EPA June 1996**
**Comment 3-2**

Section 3.2, 3rd P: The interpretation of how FO39 waste changes from a listed waste to "leachate contained-in' environmental media'" is not correct. The only way to remove its listing

as FO39 is to delist it. It is not a contaminated medium. It is a listed waste. Contaminated media containing hazardous wastes are different.

**Response to Comment 3-2**

*Although the concept of the leachate as "leachate contained-in environmental media" was accepted in the March 1996 Draft of the Decision Document, it will be removed in the next revision.*

**EPA June 1996**
**Comment 6-5**

Describe in detail how the water in the East Landfill Pond will be removed.

**Response to Comment 6-5**

*The water will be removed following the general provisions of the Pondwater Management Plan. A specific plan will be developed during Title II design.*

**EPA June 1996**
**Comment 6-8**

Approx. the 5th P "The cover for Alternative 2 meets all...") Because this landfill is closing, it is not required to meet EPA requirements for a Subtitle C cap as described in Section 264 and 265. Including this state met here is confusing and gives the appearance that DOE will be doing less then it is supposed to. This statement should be eliminated.

**Response to Comment 6-8**

*The statement will be eliminated as suggested.*

**EPA June 1996**
**Comment 6-17**

1stP, Section 6.3.1, 2nd sentence. If the cap eliminates 1/2 the total flow of 2 gpm, then the flow will be negligible to none. These two controls, the cap and the slurry wall are relatively equal which is not reflected in this sentence. Secondly, are these numbers correct:

**Response to Comment 6-17**

*The numbers are believed correct but will be verified during the next revision of the document. If they are found correct, the equality of the controls will be reflected in the sentence.*

**EPA June 1996**
**Comment 7-2**

3rd P, 2nd sentence: This sentence does not agree with the next to last sentence on p. 8-2, regarding removal or burial in place of the leachate treatment system.

**Response to Comment 7-2**

*The sentences will be revised for clarity.*

**EPA June 1996**
**Comment 7-5**

Why isn't reference EPA (1989e) included in the list of documents re: HW landfills?

**Response to Comment 7-5**

*The EPA reference will be reviewed for inclusion in the list of documents.*

**EPA June 1996**
**Comment 8-1**

1st P, last two sentences: "Specific closure requirements for interim status landfills are . . .requirements for hazardous waste storage units."

**Response to Comment 8-1**

*The sentences will be changed as suggested.*

**EPA June 1996**
**Comment 8-3**

4th P - How can the landfill be closed in the spring and summer of 1997 when right now it is targeted to go through closure in 1998? This is in part based on the delay in the Title II design.

**Response**

*The document will be revised to reflect any timeline uncertainties.*

**EPA June 1996**
**Comment 8-4**

Section 8.1.7.: Since the plan is to remove the water in the East Landfill pond during closure, why does this paragraph state that the water level in the pond will be lowered? Is this an interim action prior to removal?

**Response to Comment 8-4**

*Lowering of the pondwater elevation is required as a pre-construction activity.*

**EPA June 1996**
**Comment 8-7**

"Point of Compliance", 1st sentence: "Postclosure groundwater-monitoring requirements are applicable, relevant. . ." (compliance with 265, Subpart F is a requirement for interim status landfills during postclosure, 265.310 (b) (3)).

**Response to Comment 8-7**

*The sentence will be revised as recommended.*

**EPA June 1996**
**Comment 8-11**

The closure timeline does not agree with the fact that no funds have been set aside in FY96 for design.

**Response to Comment 8-11**

*The closure timeline will be updated to reflect current budget impacts.*

**EPA June 1996**
**Comment 8-13**

Because iron is the only parameter which might exceed ARARs at he point of compliance (p. 3-13), Fe should be added to Table 8-3.

**Response to Comment 8-13**

*Table 8-3 will be revised to include iron.*

**EPA June 1996**
**Draft Proposed Plan**
**Comment Page 1**

Comments should be sent to EPA as it will have the lead for OU 7, as soon as it is approved.

**Response Comment Page 1**

*The proposed plan will be revised as recommended.*

**EPA June 1996**
**Draft Proposed Plan**
**Comment Page 2**

1st column, 1st P: Dates for the public comment period need to be revised.

**Response Comment Page 2**

*The proposed plan will be revised as recommended.*

**EPA June 1996**
**Draft Proposed Plan**
**Comment Page 2**

2nd column, last sentence: see comment for p. 2-1.

**Response to Comment Page 2**

*The proposed plan will be revised as recommended.*

**EPA June 1996**
**Draft Proposed Plan**
**Comment Page 3**

1st column, last sentence: "Response actions. . . leachate-collection trench, two slurry walls, and a passive. . ."

**Response to Comment Page 3**

*The sentence will be revised as recommended.*

**EPA June 1996**
**Draft Proposed Plan**
**Comment Page 3**

2nd column, 3rd P, 2nd sentence is very confusing. Perhaps just rephrasing "analytes do not exceed ARARs" would help.

**Response to Comment Page 3**

*The sentence will be revised for clarity.*

**EPA June 1996**
**Draft Proposed Plan**
**Comment Page 4**

2nd column, #1, 1st sentence: "criteria" to "criterion"
2nd column, #5, 1st sentence: "present" to "presents"
2nd column, #7: The difference between $10.5M, $11.7M, and $11.4M does not appear to be significant.

**Response to Comment Page 4**

*Changes will be made as recommended.*

**EPA June 1996**
**General**

There is no discussion of the two upgradient plumes associated with OU 6 in this document. In the Technical Memorandum for OU 7 dated 9/94 on p. v in the Executive Summary, it states that these plumes will be addressed along with OU 10 and OU 6. Please discuss in detail where and how these plumes will be addressed

**Response to Comment 1**

*The OU 10/OU 6 plume(s) will be addressed by the Site Groundwater Strategy.*

# CDPHE COMMENTS

## CDPHE August 1996
## Comment 1

Page ES-2 "Seep Water Discharge to Groundwater" is included with Alternatives 2, 3 and 4. Please replace the above phrase with Seep Waster Discharge Collection and Treatment/Disposal" for Alternatives 2, 3, 4.

### Response to Comment 1

*The text will be revised as recommended.*

## CDPHE August 1996
## Comment 2

Alternative 2 as described in this text is not considered acceptable. Low permeability zone material used in the cover must have a coefficient of permeability of no more that 1E-07 cm/sec. The exclusive use of a geonet/geotextile geocomposite for the gas collection system is questionable based on the proposed cover configuration and the absence of published studies of the same application at other sites.

### Response to Comment 2

*The low permeability soil cover option will not be considered in the next revision of the Decision Document. Published studies of geonet/geotextile/geocomposite systems for gas collection will be compiled and presented to CDPHE and EPA prior to the next revision of the Decision Document.*

## CDPHE August 1996
## Comment 3

The text states" "Leachate at the seep would be discharged to alluvial groundwater downgradient of the cap." The above statement should be replaced with, "Leachate at the seep would be collected and the source and treated."

### Response to Comment 3

*The text will be revised during the next revision to reflect ongoing discussions among DOE, EPA and CDPHE concerning the correct management of the leachate (Comment #28 CDPHE, August 1996)..*

**CDPHE August 1996**
**Comment 4**

"Leachate collection (and treatment if needed) is listed as part of the containment presumptive remedy. Please replace "(and treatment if needed)" with "at the source and treatment" in the above item. The revised text should also include leachate treatment as a required component of the presumptive remedy.

**Response to Comment 4**

*The text will be revised during the next revision to reflect ongoing discussions among DOE, EPA and CDPHE concerning the correct management of the leachate (Comment #28 CDPHE, August 1996).*

**CDPHE August 1996**
**Comment 5**

Prior to removal of the East Landfill Pond dam, the Dam Safety Branch of the State Engineer's Office must be notified (contact Alan Perarson, Principal Engineer). A Notice of Intent to Breach a Dam must be filed with that office.

**Response to Comment 5**

*The Dam Safety Branch of the State Engineer's Office will be notified prior to removal of the East Landfill Pond dam and a Notice of Intent to Breach a Dam will be filed with that office.*

**CDPHE August 1996**
**Comment 6**

Page 2-8. The text refers to Figure 2-5, which does not show borehole locations as indicated. A figure which indicates the locations of all boreholes should be included in the revised text.

**Response to Comment 6**

*The figure will be revised to show the locations of all boreholes indicated in the text.*

**CDPHE August 1996**
**Comment 7**

Page 2-9. The text states: "Flow in unweathered bedrock is so small that any potential contaminant transport occurs by diffusion." However, contaminant transport in unweathered bedrock may also occur via advective flow. The above statement needs to clarify that contaminants transport occurs primarily via diffusive transport if that is the intent.

**Comment 7**

*The statement will be clarified as recommended.*

**CDPHE August 1996**
**Comment 8**

Page 2-15. A relative greater quantity of groundwater flowing into the landfill is expected since additional upgradient diversion facilities are now not anticipated. This decreased protectiveness should be offset by increasing the cover's factor of safety against infiltration of precipitation. Applicable EPA guidance recommendations and standard engineering practice should be used in the selection of optimum cover components.

A French drain system may be a reasonable alternative to the slurry wall repair/upgrade project that was previously proposed.

**Response to Comment 8**

*Upgradient groundwater control options will be reevaluated during the next revision of the Decision Document. Applicable EPA guidance recommendations and standard engineering practice will be used in the selection of optimum cover components and groundwater control systems.*

**CDPHE August 1996**
**Comment 9**

Page 2-16. The discussion of vegetation fails to address riparian areas. Please add the following text from the original version to the revised text: "Riparian areas downgradient of the East Landfill Pond are poorly developed and lack extensive woody vegetation. Relatively well-developed riparian areas of North Walnut Creek lie approximately one-half mile to the south (DOE 1995c)

### Response to Comment 9

*The text will be added during the next revision of the Decision Document.*

### CDPHE August 1996
### Comment 10

Pages 2-21 and 2-25. The rationale for not considering silicon, bicarbonate as $CaCO_3$, carbonate as $CaCO_3$, carbonate, fluoride orthophosphate, total dissolved solids, total organic carbon, dissolved organic carbon, gross alpha and gross beta contaminants needs to be included or at least referenced in the text.

### Response to Comment 10

*The rationale for not considering silicon bicarbonates as $CaCO_3$, carbonate as $CaCO_3$, carbonate, fluoride, orthophosphate, total dissolved solids, total organic carbon, dissolved organic carbon, gross alpha and gross beta will be included in the text.*

### CDPHE August 1996
### Comment 11

Page 3-2. Potential exposure pathways associated with inhalation and explosion of landfill gas at the Present Landfill should be addressed in the text.

### Response to Comment 11

*Potential exposure pathways associated with inhalation and explosion of landfill gas at the Present Landfill will be addressed during the next revision of the Decision Document.*

### CDPHE August 1996
### Comment 12

Page 3-2. See comment #28 in regards to the discussion of leachate in Section 3.2 Conceptual Site Model.

### Response to Comment 12

*The discussion of leachate in Section 3.2 will be changed during the next revision to reflect the leachate option (from Comment #28) agreed to by DOE, EPA and CDPHE.*

**CDPHE August 1996**
**Comment 13**

Page 3-3. The statement that, "discharge of leachate contained in groundwater to surface water below the dam is not expected" must be explained and justified.

**Response to Comment 13**

*Leachate control options will be reevaluated during the next revision of the Decision Document. The statement will be eliminated or explained/justified as appropriate.*

**CDPHE August 1996**
**Comment 14**

Pages 3-3, 3-4, and 3-9. The ecological risk assessment evaluated risks to small mammals via inhalation of volatilized organic compounds in burrows. The contribution of landfill leachate to this pathway should be included.

**Response to Comment 14**

*The ecological risk assessment performed for the March 1996 draft of the Decision Document, but removed in the August revision will be again added to the next Revision of the Document. The risk assessment will be augmented to included inhalation of volatiles by burrowing mammals outside of areas covered under the presumptive remedy.*

**CDPHE August 1996**
**Comment 15**

Page 3-4. Neither the text nor Figure 3-3 adequately addresses what is required for environmental media that falls into the 10-4 to 10-6 risk ranges. The RFCA indicates that soils and groundwater found to be in this range will be managed. management may include remedial action or further evaluation. The flow chart in Figure 3-3 implies that the response to a risk within this range is exactly the same as to a risk below 10-6

**Response to Comment 15**

*The text will be revised during the next revision of the Decision Document to reflect the outcome of discussions among EPA, CDPHE and DOE concerning environmental media that falls into the 10-4 to 10-6 risk ranges.*

**CDPHE August 1996**
**Comment 16**

Page 3-6. The MCL and MCLG for barium is 2.0 mg/L, not 2,000 mg/L.

**Response to Comment 16**

*The barium standard will be changed during the next revision of the Decision Document. All other standards will be reviewed and updated to reflect any regulatory changes that take place between March 1995 and the next revision.*

**CDPHE August 1996**
**Comment 17**

The use of a matrix effect in risk assessment calculations is not allowed and this factor must be deleted from the equations on this page . The paragraphs describing this factor should also be removed from this section.

**Response to Comment 17**

*The matrix effect factor and paragraphs describing the factor will be removed unless risk assessment methodology changes prior to the next revision of the document to included the matrix effect.*

**CDPHE August 1996**
**Comment 18**

Page 3-12. The ARAR for total iron is 1 mg/L, not 1,000 mg/L.

**Response to Comment 18**

*The ARAR will be corrected.*

**CDPHE August 1996**
**Comment 19**

Under Wetlands Requirements, "Table 3-22" should be referenced instead of "Table 3-20".

**Response to Comment 19**

*The table reference will be corrected.*

**CDPHE August 1996**
**Comment 20**

Table 3-1. Either the units should be changed from mg/L to ug/L or the PRGs values (except the 2 radionuclides should be divided by 1,000. A heading for the units column should be included. The radionuclides section header is not centered like the other headers.

**Response to Comment 20**

*The units in Table 3-1, 3-2 and 3-15 will be corrected. The Tables will be revised with consistent format.*

**CDPHE August 1996**
**Comment 21**

Table 3-2. Either the units should be changed from mg/L to ug/L or the PRGs values (except the 2 radionuclides should be divided by 1,000. Several discrepancies exist between the State surface water standards and the values listed in this table. Table 1 in Attachment 5 of the RFCA contains a compilation of the surface water standard to check these values against. Acute standard exist for some of the PCOCs which are footnoted as having no standard available.

**Response to Comment 21**

*Please see response to Comment 20.*

**CDPHE August 1996**
**Comment 22**

Table 3-15. Either the units should be changed from mg/L to ug/L or the PPRG values (except the 2 radionuclides) should be divided by 1,000. Discrepancies exist between the State Surface water standard and the values listed in this table. Table 1 in Attachment 5 of RFCA contains a compilation of the surface eater standards to check these values against. Acute standards exist for some of the PCOCs which are footnoted as having no standard available.

**Response to Comment 22**

*Please see response to Comment 20.*

**CDPHE August 1996**
**Comment 23**

Figure 3-3. This diagrams should be reviewed against the methodology described in Attachment 6 of RFCA, No Action/No Further Action/No Further Remedial Action Decision Criteria for RFETS, and revised as necessary. In particular, "No active response necessary" as a response to risks within the 1E-04 to 1E-06 risk range is inaccurate. While no remedial actions may be required, management actions, including institutional controls may likely be required and are considered to be "active" responses.

**Response to Comment 23**

*The RFCA was not approved at the time the diagrams were produced. The diagram will be reviewed against RFCA requirements and revised during the next revision of the Decision Document.*

**CDPHE August 1996**
**Comment 24**

Page 5-3 To a civil engineer, soils is any uncemented or weakly cemented accumulation of mineral particles formed by the weathering of rocks, the void space between the particles containing water and/or air (R.F. Craig, Soil Mechanics, 1981). It is acknowledged that the permeability of the cover should be less than the 1E-07 cm/sec permeability of the underlying weathered bedrock.

**Response to Comment 24**

*The definition of soil on page 5-3 will be revised during the next revision of the Decision Document.*

**CDPHE August 1996**
**Comment 25**

Page 5-6 The text states, "The Kettleman Hills hazardous waste landfill facility in California successfully used a geonet in 1989 as a biotic barrier for the cover system." Please provide a published study of the above geonet application. Also please, provide the geonet manufacture's recommended application for their geonet product.

**Response to Comment 25**

*Prior to the next revision of the Decision Document, all information regarding the use of geonets as biotic barriers and their effectiveness will be presented to CDPHE and EPA for review and discussion.. Likewise, so will the manufacturer's recommnedations concerning applications of their products.*

**CDPHE August 1996**
**Comment 26**

Page 5-8. The text states, " The HELP model shows an average annual leakage rate of 1.1 in/year (figure 5-4)." Figure 5-4 indicates that there are 9 cover alternatives which is inconsistent with the text. This discrepancy should be corrected.

**Response to Comment 26**

*The discrepancy between the text and the Figure will be corrected.*

**CDPHE August 1996**
**Comment 27**

Page 5-15. The text states, " The presence of the low-permeability (approximate 1E-05 to 1E-07 cm/sec) soil gives the cover system some of the benefits of a composite cover without the rigorous installation requirements of a full compacted clay"

The phrase in parenthesis above should be corrected to read "(less than the 1E-05 cm/sec)" to be consistent with the rest or the text.

It is debatable that the installation requirements of the "low-permeability" soil would be less rigorous than for clay. Please justify or delete references regarding "low permeability" soils having less rigorous installation requirements that lays.

**Response to Comment 27**

*The Low-Permeability Soil Cover will not be considered as an option for evaluation in the next revision of the Decision Document.*

**CDPHE August 1996**
**Comment 28**

Leachate collection, treatment and discharge are discussed in Section 5.4 and elsewhere in the text. Three options to deal with leachate in general and with the components which cause the leachate to be a listed waste in particular are presented below. Any of these options must also include a strategy to address the "relatively high potential for toxic effects [to aquatic life] from chemical concentrations in leachate seep water" mentioned in the final paragraph of Section 3.3.2 on page 3-6.

A) Under a formal delisting procedure, the following issues must be addressed by any remedial options dealing with the leachate:

The Present Landfill leachate is itself an FO39 listed waste by virtue of its having percolated through multiple hazardous wastes. It is not, therefore, a hazardous waste contained in an environmental medium.

The recently-installed leachate collection and treatment system is expected to be able to treat leachate to delistable levels. This leachate collection and treatment system or an alternative long-term system must remain in-place until untreated leachate can be delisted. Continued monitoring must ensure that delisting levels are being maintained.

3. To delist treated or untreated leachate the Colorado Hazardous Waste Commission must be petitioned:

- - Follow the requirements in 6 CCR 1007-3 250.20 and 260.22

- - The petition must include a demonstration that the leachate does not meet any of the criteria under which the waste was listed as a hazardous waste and that other factors, including additional constituents, do not warrant retaining the wastes as a hazardous waste. DOE may use a risk basis to provide that the leachate in nonhazardous and to establish delisting levels against which all constituents can be measure. Normally risk levels must be < 10-6 to a residential receptor with a Hazardous Index <1. If a decision document (e.g., ROD or site-wide agreement) establishes controls that will prevent mismanagement of the particular waste, then an alternative receptor prescribed by that document can be used to calculate conditional delisting levels. That is, on-site treatment of the leachate will allow the use of PPRGs for land uses determined by RFCA as the conditional delisting levels.

4. The following items need to be included in this IM/IRA Decision Document, discussed in the Proposed Plan and incorporated into the ROD:

- - Delisting method/plan

- - Basis for a conditional de-listing (e.g. 10-6 risk to an open space user; if this basis changes, the determination changes;

- - The land use controls which allow a conditional delisting must be specified and established in the final ROD

- - Evidence that the leachate will not violate ARARs

- - Verification testing: description of sample collection methods and frequency, and sample analysis

B) As an alternative to a formal delisting process, a comparison against substantive requirements of ARARs, including State surface water/groundwater standards, will be considered sufficient and will constitute a conditional delisting.

The recently-installed leachate collection and treatment system is expected to be able to treat leachate to meet ARARs. This leachate collection and treatment system or an alternative long-term treatment system must remain in-place until untreated leachate can meet ARARs. Continued monitoring must ensure that standards are being maintained.

A plan to address leachate which includes an ARARs analysis and continued monitoring must be included in this IM/IRA Decision Document, discussed in the Proposed Plan and incorporated into the ROD

C) If the leachate outfall is considered a point source discharge under the NPDES permit then the issue of leachate as a listed waste will be covered by that permit and delisting will not be required. The permit should include State surface water standards as ARARs. It is not currently the intention of EPA Region VIII to re-issue the NPDES permit early n 1997, following the December 1996 Colorado Water Quality Control Commission hearing.

The leachate collection and treatment system or an alternative long-term treatment system must remain in-place until untreated leachate can meet ARARs. Continued monitoring must ensure that standard are being maintained.

A description of how leachate will be handled under the NPDES permit must be included in this IM/IRA Decision Document, discussed in the Proposed Plan and incorporated in the ROD.

**Response to Comment 28**

*Meetings wth CDPHE and EPA will be scheduled to discuss Comment 28. Once a leachate option is agreed to, the Decision Document can be revised.*

**CDPHE August 1996**
**Comment 29**

Page 5-27 A release of seep water (FO39 listed hazardous waste) to environmental media is not considered control. Also, burying the seep and intentionally redirecting the seep discharge to groundwater is not considered natural attenuation. The Discharge to Groundwater section must be based on the remise that any discharges will meet ARARs. The currently proposed Rocky Flats Cleanup Agreement incorporates land use control which prohibit groundwater use. The Agreement, however, does not allow discharging to groundwater in excess of ARARs. The statement that risk to ecological receptors would be eliminated by discharging leachate to groundwater is debatable and should be modified or deleted from the text.

**Response to Comment 29**

*The leachate control options will be reevaluated during the next revision of the Decision Document once consensus is reached among DOE, EPA and CDPHE concerning Comment 28 above.*

**CDPHE August 1996**
**Comment 30**

The text states "A composite made up of geonet with filter fabric on each side will be rolled out over the general fill for gas collection. The geonet will be sandwiched between two layers of filter fabric to prevent fines from clogging the geonet." The geonet apertures will potential be clogged by filter fabric materials when the overlying low permeability zone soil is compacted using heavy equipment.

**Response to Comment 30**

*Proper CQA reflected in the Technical Specifications will ensure that the geonet aperature will not be clogged by filter fabric materials when overlying layers are compacted using heavy equipment. In addition, prior to revision of the Decision Document, information concerning the use of geonets in gas collection systems will be presented to CDPHE and EPA for review.*

**CDPHE August 1996**
**Comment 31**

Pages 6-6 and 6-7. A gas venting system is discussed in Gas-collection Layer and Overall Protection of Human Health and the Environment sections. The text should state that the gas-collection system will also be configured to convey gas for treatment if needed (as well as for ventilation). The exclusive used of a geonet geocomposite for gas collection does not appear to follow standard engineering proactive or EPA guidance. Therefore, the details regarding the geonet geocomposite/gravel column connections must be presented for review.

**Response to Comment 31**

*The text will be revised as recommended*

**CDPHE August 1996**
**Comment 32**

Pages 7-1 and 7-2. The gas collection layer should also be included in lists of cover layers.

**Response to Comment 32**

*The gas collection layer will also be included in the list of cover layers.*

**CDPHE August 1996**
**Comment 33**

Page 7-3. A gas treatment system is proposed to be attached to the gravel column vents. This proposed design appears to be somewhat unconventional. The connection details must be presented for review.

**Response to Comment 33**

*Connection details will be presented for review.*

**CDPHE August 1996**
**Comment 34**

Page 7-8. The text states, " The only requirements for the general fill are that it is placed and compacted to form an unyielding subgrade for construction of the cover system and that it is sufficiently permeable to allow vertical migration of gases generated in the waste."

The text should also relate that the general fill must not contain deleterious or frozen materials. The general fill will also be subject to compaction specifications.

### Response to Comment 34

*The text will be revised as recommended.*

### CDPHE August 1996
### Comment 35

Page 7-8 The text states," for example, if settlement occurs in the central portion of the landfill, the cover becomes compressed. The physical flexibility properties of the soil and geosynthetic materials components allow the cover to sustain more displacement without rupturing"

The text should relate that cover components will ordinarily experience tension forces in response to settlement. Calculations which support that the proposed geosynthetic cover materials (i.e. FMC, geonet, Filter fabrics will remain intact/function when subject to localized settlement of 5.5 feet should be included in the document.

### Response to Comment 35

*The text will be revised to reflect that cover components will ordinarily experience tension forces in response to localized settlement. Calculations will be provided to support the integrity of the goesynthetic materials subjected to localized settlement of 5.5 feet.*

### CDPHE August 1996
### Comment 36

Page 7-8. Please provide details about the geosynthetic boots designed to restrict infiltration around pipe penetrations.

### Response to Comment 36

*Details concerning geosynthetic boots designed to restrict infiltration around pipe penetrations will be provided.*

### CDPHE August 1996
### Comment 37

Page 7-9. This text about seep water discharge to groundwater must include a discussion on how ARARs will be met as mentioned in Comment #28 above.

**Response to Comment 37**

*Once a consensus among DOE, EPA and CDPHE is made concerning the appropriate leachate option in from Comment #28, the leachate control options will be evaluated. These options may or may not included discharge to groundwater. If a discharge to groundwater scenario is still considered a viable options, the text will be revised to discuss how ARARs will be met.*

**CDPHE August 1996**
**Comment 38**

Page 7-9. The text states, "Lateral migration of landfill gas is prevented by the existing slurry wall. "The word "mitigated" should be use instead of "prevented."

**Response to Comment 38**

*The text will be revised as suggested.*

**CDPHE August 1996**
**Comment 39**

Page 8-1. OU 7 owes its condition as an interim status closure unit to the Rocky Flats RCRA permit. In order to be complete, this should be mentioned in is section.

**Response to Comment 39**

*The text will be revised to discuss the interim status closure unit condition of OU 7.*

**CDPHE August 1996**
**Comment 40**

Page 8-2. In addition to the listed items, the closure plan should also describe leachate collection and treatment. Discharging leachate to groundwater at levels above ARARs is not considered proper disposal.

An estimate of the maximum inventory of hazardous waste ever on-site over the active life of the facility must be included or referenced in the closure plan. The closure plan must also include a detailed description of the steps needed to remove or decontaminate all hazardous waste residues and contaminated containment system components, equipment, structures, and soils during partial and final closure, including but not limited to methods for removing transporting, treating, storing or disposal of all hazardous waste.

### Response to Comment 40

*The Closure plan will be revised as recommended.*

### CDPHE August 1996
### Comment 41

Page 8-6. Post closure maintenance activities described in Section 8.2.2 should also include repair of all cover components due to settlement and seasonal damage.

### Response to Comment 41

*The text will be revised to include repair of all cover components due to settlement and seasonal damage.*

### CDPHE August 1996
### Comment 42

Page 8-7. There are potential concerns with regard to the proposed point of compliance wells. At least three wells are required to be installed at depths and location such that they can immediately detect hazardous waste constituents. Well 53194 may be too far away from the landfill to be able to comply with this requirement. Wells 4087 and B206989 are located immediately downgradient of the East Landfill pond dam and have suffered from the apparent effects of the "dam shadow".

### Response to Comment 42

*Once consensus is reached among EPA, CDPHE, and DOE concerning leachate options described in Comment #28, post-closure monitoring wells will be reevaluated.*

### CDPHE August 1996
### Comment 43

Page 8-8. Of the three wells mentioned in the text as upgradient alluvial wells for postclosure monitoring, only Well 70093 appears in Figure 8-2. Please illustrate the other well locations.

### Response to Comment 43

*The Figure will be revised to include all well locations.*

**CDPHE August 1996**
**Comment 44**

Table 8-3. Iron, Manganese, Phenols, pH, Specific Conductance, Total Organic Carbon and Total Organic Halogen must also be included as groundwater monitoring parameters.

**Response to Comment 44**

*The parameters stated will be reviewed for inclusion on the groundwater monitoring list for OU 7.*

**EPA March 1996**
**Comment 1, Page J-10**
**Landfill Design**

The OU 7 DD evaluates three cover systems to cap the OU 7 landfill. The only difference among the three alternatives is the design of the low-permeability layer(s). All three alternatives include a flexible membrane cover (FMC). Underlying the FMC, Alternative A (previously Alternative 5) includes soil bedding material, Alternative E (previously Alternative 7) includes 12 in. of low-permeability (1E-05 centimeters per second [cm/sec]) soil, and Alternative G (previously Alternative 9) includes 24 in. of clay (1E-07 cm/sec). According to the document, Alternative E is the recommended alternative. Compared to Alternative G, Alternative E has greater long-term effectiveness, is easier to implement, has lower costs, and has greater short-term effectiveness. The conclusion that Alternative E has greater long-term effectiveness should be further supported for several reasons. The reasons are enumerated below

According to the report, Alternative E has greater long-term effectiveness because the clay layer in Alternative G is subject to desiccation cracking and is therefore more prone to leakage if the FMC ruptures. The report states that covers constructed with clay materials at high moisture contents may be subject to more desiccation than covers constructed of soil materials at a lower moisture content. This statement requires further rational, as it contradicts landfill closure regulations, standard accepted practices, and EPA guidance (EPA 1985, 1989b, 1991b). Furthermore, if water is percolating through a ruptured FMC, it seems that any underlying desiccated clay will rehydrate and function as intended

**March 1996 Response**

*Seven cover systems were evaluated in the revised OU 7 Decision Document.*

*In general, factors that influence clay layer desiccation include the clay mineralogy, plasticity, sand content, initial moisture content, temperature variations, nature of the clay's contact with overlying geomembrane or underlying surface, and overburden pressures. These factors have been investigated by several researchers, and it has been suggested that a clay layer having a lower swelling potential, lower plasticity index, lower initial moisture content, and a thicker vegetative soil cover which provides sufficient temperature insulation and overburden pressure to maintain a tight contact between the clay and the overlying geomembrane will be less likely to desiccate than a clay layer that does not have these characteristics.*

*The low-permeability soil layer proposed for Alternative E is intended to incorporate many of the factors identified above to reduce the potential for clay desiccation compared to the clay layer proposed in Alternative G.*

*Clay healing generally applies to clay liner systems that will be subjected to high overburden pressures from overlying waste fills. In cases of very large landfills, the clay can be become highly compressed causing a redistribution of the clay to close cracks and voids. These high overburden pressures are typically not present in cover systems.*

*The ability of a clay to rehydrate after cracking is very dependent on the characteristic of the clay. A pure bentonitic clay such as GCL will hydrate and achieve a permeability similar to a pre-drying condition; however, normal compacted clay covers would not have the potential to totally rehydrate and achieve a permeability equal to the pre-drying permeability.*

**CDPHE August 1996**
**Comment 45**
**Refers to EPA Comment 1, Landfill Design, Page J-10**

Desiccated and fissured clays may have a coefficient of permeability of 1E-05 cm/sec (Soil Mechanics, R. F. Craig, 2nd Edition, 1978) which is equal to that proposed for Alternative E. Clayey grovels typically have a coefficient of permeability greater than 5E-08 cm/sec (Civil Engineering Reference Manual, Fourth Edition, 1986). However, gravels could promote penetration of the overlying FML. The soil type(s) proposed for use in Alternative E must be specified.

Soils compacted at water contents less than optimum ("dry of optimum") tend to have relatively high hydraulic conductivity whereas soils compacted at water contents greater than optimum ("wet of optimum") tend to have a low hydraulic conductivity. It is usually preferable to compact the soil wet of optimum to achieve minimal hydraulic conductivity (Design and Construction of RCRA/CERCLA Final Covers, EPA/625/4-91/025, Seminar Publication). The ability of fissures or holes to heal in a soil depends largely upon soil moisture content, soil

plasticity, the size of the fissure or hole, and ambient stress. Wetter, more plastic soils have a greater healing capability (USDI, 1974) (Design, Constructor, and ND Evaluation of Clay Liners for Waste Management Facilities, EPA/530/SW-86/0007F, November 1988).

The higher the water content of the soil and the higher the plasticity of the soil, the greater is the shrinkage potential from desiccation. There are two ways to provide the required protection after construction. One way is to bury the liner beneath an adequate depth of soil overburden; another technique is to place a geomembrane over the soil. If a geomembrane liner is place on a soil liner to form a composite, it is often convenient to overbuild the soil liner (i.e., make it thicker than necessary) and then to scrape away a few inches of potentially desiccated surficial soil just before the geomembrane is placed (Design and Construction of RCRA/CERCLA Final Covers, EPA/625/4-91/025, Seminar Publication).

Clay liners may be subject to developing desiccation cracks during and immediately after installation. The clay may be protected from desiccation after construction by installing a synthetic membrane; by installing 1 to 2 feet of soil; or for surface impoundments, by putting liquids into the impoundment immediately after construction (Design, Construction, and Evaluation of Clay Liners for Waste Management Facilities, EPA/538/SW-86/007F, November 1988).

Also, EPA guidance (Design and Construction of RCRA/CERCLA Final Covers) recommends that the low hydraulic conductivity geomembrane/soil layer be 60 cm (2 feet) as shown in Alternative 9 (Figure 6-4) of the August 24, 1995, draft document. All March 1996 draft document alternatives provide for only one foot depth of "low permeability" soil. An additional foot of material will mitigate desiccation damage thereby increasing protection.

Colorado Hazardous Waste Regulations, 6 CCR 1007-3, Section 265.318(a)(5) states: At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final closure designed and constructed to: Have a Permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Section 264.301(c)(1)()(B) indicates that the compacted soil component of the bottom liner system must have a hydraulic conductivity of no more than 1E-07 cm/sec. The revised draft document indicates that test samples from shallow subsurface soils drilled near the landfill are classified as fat clay (i.e., highly plastic clay). These soils correspond to "impervious" soils, e.g., homogeneous clays below the zone of weathering which have coefficients of permeabilities less than 1E-07 cm/sec (An Introduction to Geotechnical Engineer, Robert D. Holtz and William D. Kovacs, 1981).

Given identical site conditions, a suitably lined landfill would be expected to have less contaminant migration than the present landfill since it will not incorporate a bottom liner. For

this reason, it is particularly imperative that cover soils with a coefficient of permeability of no more than 1E-07 cm/sec be used for the low permeability zone layer.

### Response to Comment 45

*The Low-permeability soil cover option will not be evaluated in the next revision of the Decision Document.*

### EPA March 1996
### Comment 2, Page J-11
### Landfill Design

According to EPA guidance (1989b), a dual-component barrier system is desirable because the layers complement each other. The FMC will tend to roof over the inconsistencies in the underlying compacted soils, while the compacted soil will tend to significantly impede the flow of any leakage through a hole in the overlying FMC (EPA 1989b). In addition, placing an FMC above a moist clay layer tends to protect the clay from desiccation. Finally, each component tends to back up the other in the event of a failure of either component (EPA 1989b). If there is leakage through a hole in the FMC or if the FMC significantly ruptures, 24 in. of clay with a hydraulic conductivity of 1E-07 cm/sec (Alternative G) will be more effective than a 12-in. soil layer with a hydraulic conductivity 100 times larger (Alternative E). The Hydrologic Evaluation of Landfill Performance (HELP) model should be rerun to determine how well the two soil layers "back up" the FMC in the event of failure or slight leakage.

### Response

*We concur with the EPA guidance documents that recommended a dual-component barrier system. A composite system is the basis for the proposed Alternative (Alternative E) which includes an FMC over a low-permeability soil. However, we are concerned that in the long run a highly plastic, high moisture content clay (Alternative 9) will eventually dry and crack. The cracks will form soil irregularities and stress concentrations in the FMC that may result in defects in the FMC. Holes in the FMC directly above desiccation cracks may result in infiltrating water having a direct conduit to the waste. Although this cannot be accurately modeled, this condition is considered to be worse than an intact FMC overlying a low-permeability soil (1x10-5 - 1x10-7 cm/sec) that is not cracked.*

*The HELP analyses that were conducted in support of the selection of Alternative 7 evaluated the impacts of expected defects in the FMC for both Alternatives 7 and 9. Recommended defect rates were included in the HELP analyses for both alternatives, and the results indicated leakage rates of 1.6x10-4 in. (average annual totals) for Alternative 7 and 1x10-5 in. for Alternative 9.*

*This corresponds to 0.001 percent of rainfall for Alternative 7 and 0.00007 of rainfall for Alternative 9. This is not considered to be a large difference.*

*We concur that if a large defect occurs in the FMC that a 1 x10-5 cm/sec clay will allow considerably more water to infiltrate than a 1 x 10-7 cm/sec clay. However, large defects or ruptures in the cover should not occur if a proper construction quality assurance (CQA) program (as recommended by the EPA) is implemented during construction. Large defects and/or ruptures that may occur after construction should be observable from the surface during normal inspections and could be repaired.*

**CDPHE August 1996**
**Refers to Landfill Design Comment 2**
**Comment 46**

Concerns that a highly plastic, high moisture content clay will eventually dry and crack should translate into efforts to determine the evaporative zone depth at the site.

**Response to Comment 46**

*The evaporative zone depth at the site will be determined prior to Title II Design Development.*

**Third paragraph of Response to EPA Landfill Design Comment 2, page J-11,**

*We concur that if a large defect occurs in the FMC that a 1 x10-5 cm/sec clay will allow considerably more water to infiltrate than a 1 x 10-7 cm/sec clay. However, large defects or ruptures in the cover should not occur if a proper construction quality assurance (CQA) program (as recommended by the EPA) is implemented during construction. Large defects and/or ruptures that may occur after construction should be observable from the surface during normal inspections and could be repaired.*

**CDPHE August 1996**
**Comment 47(refers to EPA Landfill Design Comment 2, Third Paragraph)**

A 1 x 10-5 "low permeability" soil will also allow considerable more water to infiltrate than a 1 x 10-7 clay.

**Response to Comment 47**

*The low-permeability soil cover option will not be considered in the revision of the Decision Document.*

**EPA March 1996**
**Comment 3, Page J-12**
**Landfill Design**

Landfill closure regulations typically require final covers to have hydraulic conductivities less than or equal to the hydraulic conductivity of the underlying soils. The OU 7 DD assumes the hydraulic conductivity of the weathered bedrock below the landfill to be approximately 1E-07 cm/sec. If there is leakage through a hole in the FMC or if the FMC significantly ruptures, the 12- in. soil layer's hydraulic conductivity of 1E-05 cm/sec is not less than the underlying soils, as required. Therefore, leakage into the landfill could exceed seepage out, resulting in the "bathtub" effect. This effect is undesirable because waste can become saturated and produce highly concentrated leachate. In addition, leachate hydraulic heads will increase within the landfill, which can increase leakage rates out.

**Response**

*In comparing the permeability of the cover system with the permeability of the subsurface, we have utilized the permeability values for the subsurface that were based on field scale tests and the composite permeability of the FMC and the low-permeability soil. We do not believe that it is appropriate to compare the permeability of the low-permeability soil directly below a small defect (1 cm in diameter considered typical for a good CQA program) and the field-scale permeability values. As stated above, large ruptures during construction should be located and repaired as part of the CQA program. Large ruptures after construction should be noted during regular inspections and could be repaired.*

**CDPHE August 1996**
**Comment 48 (refers to EPA Landfill Design Comment 3)**

The above response fails to address the original comment regarding the conditions which create the potential for the "bathtub' effect to occur.

**Response to Comment 48**

*The low-permeability soil cover option will not be considered in the revision of the Decision Document. As such, a response concerning the "bathtub" effect is no longer required.*

**EPA March 1996**
**Comment 4, Page J-12**
**Landfill Design**

FMC rupture could be caused by differential settlement. Any differential settlement will also affect the soil layer below. Alternative G may be less susceptible to settlement effects as compared to Alternative E. The compacted clay component can deform somewhat more without rupturing because it is thicker and because clay has "self healing" properties as a result of the clay's shrink and swell characteristics. The text states that the potential for differential settlement is limited. However, the landfill is generating gases and decomposing. Therefore, settlement is likely to occur following cap construction. The advantages of the self-healing properties of clay and the potential for differential settlement have not been given adequate consideration in the IM/IRA.

**Response**

*We concur that differential settlement can occur at the OU 7 landfill as a result of waste settlement. However, the grading plan for the landfill requires the placement of up to 15 ft of fill to achieve surface water drainage. This fill will be placed prior to cover construction and will act to minimize localized differential settlement. Only long-term regional settlements will put the liner components into compression, minimizing the potential for cracking.*

*The self-healing aspects of a clay layer are discussed above.*

**CDPHE August 1996**
**Comment 49 (refers to EPA Landfill Design Comment 4)**

The response fails to address the original comment regarding giving the advantage of the self-healing properties of clay and the potential for differential settlement adequate consideration in the IM/IRA

Also, the placement of up to 15 feet of fill will tend to increase localized differential settlement rather than to minimize it. The effect of differential settlement will tend to put the liner components in tension rather than compression

**Response to Comment 49**

*The text will be revised to discuss the advantage of the self-healing properties of clay. Discussion of the effects of differential settlement will also be revised.*

**EPA March 1996**
**Comment 7, Page J-13**
**Landfill Design**

Alternative G includes a gas collection layer directly below the clay layer. This configuration may result in desiccation of the clay layer. The Alternative G design should consider a layer placed above the gas vent to prevent gases from desiccating the overlying clay.

**Response**

*The gas-collection layers shown in Alternative E and Alternative G are both located below the soil barrier component of the cap. This is an EPA-recommended standard design feature. Additionally, it is believed that the gas emitted from the waste will have a high moisture content and will not significantly promote desiccation in either design.*

**CDPHE August 1996**
**Comment 50**

The response adds credence to the necessity for requiring chemical compatibility testing of the lower permeability zone cover components.

**Response to Comment 50**

*Chemical compatibility testing of the cover components will be performed.*

**CDPHE August 1996**
**Refers to CDPHE Comment 13, Page J-25**
**Comment 51**

See comment 23, which discusses various leachate issues.

**Response to Comment 51**

*The outcome of future discussion concerning comment #28 (CDPHE August 1996), will be used in conjunction with Attachment 6 of the RFCA to determine the appropriate response for media with risks within the 1E-04 to 1E-06 range.*

**CDPHE March 1996**
**Comment 15, Page J-26**

Section 3.5.1.1 (Page 3-26). Because the landfill is an interim status closure unit, the requirements in 6 CCR 1007-3, §265.110 apply. The closure performance standard requires that the post-closure escape of leachate be controlled, minimized or eliminated.

**Response**

*The referenced standard states that "the owner must close the facility in a manner that:...controls, minimizes or eliminates, to the extent necessary to protect human health and the environment , post-closure escape of... leachate." A focused risk assessment for the leachate showed no risk to human health. An ecological risk assessment indicated unacceptable risk for direct contact. Therefore, in the IM/IRA DD, alternatives were developed that control, minimize, or eliminate the post-closure escape of leachate. Alternatives include cap, slurry wall, treatment of the leachate and elimination of the exposure pathway.*

**CDPHE August 1996**
**Refers to CDPHE comment 15**
**Comment 52**

It is still unclear how the preferred alternative of discharging the leachate to near-surface groundwater will eliminate this exposure pathway to burrowing mammals.

**Response to Comment 52**

*An ecological risk assessment to small burrowing mammals in areas not covered by the presumptive remedy will be performed. The outcome of discussions concerning comment #28 (CDPHE August 1996) will determine whether a discharge to near surface groundwater will remain as an option for evaluation.*

**CDPHE March 1996**
**Comment 21, Page J-28**

Section 4.2.6 (Page 4-4). This section states that vent pipes or gravel columns will extend through the cover and will be logical points for monitoring emissions from landfill. Geonets are normally used for liquid drainage applications and are only on the order of about 4 to 8 millimeters. The manner in which the vent pipes or gravel columns are attached to the gas collection geonet and then extended through the cover system should be addressed. Also explain how the gravel columns will be prevented from acting as conduits for liquids.

**Response**

*The gas generated in the waste mass will generally consist of methane which will flow upward along pathways of least resistance until it reaches the gas collection layer where it will be channeled through the cover system by gas collection pipes. These gas collection pipes will be placed at high points in the cover system.*

*Geonets and geotextiles suggested for the gas collection layer are more permeable than the overlying soil and FMC barrier layers. Some infiltration of gas into the soil layer will occur but the majority of the gas will flow through the openings in the geonet and the geotextile. The thickness of the geonet layer within the geotextile/geonet/geotextile geocomposite does not greatly affect the composite's ability to transmit gas.*

*Richardson and Koerner (1987) list geonets and geotextiles suitable for use in gas venting systems.*

*The connection between the vent pipes/gravel columns and the geonet will be addressed in the Title II design document.*

*It is anticipated that the majority of precipitation falling onto the landfill cover will either run off the gentle slopes, evaporate from the top soil and vegetative layers, or drain through the geocomposite drainage layer on top of the FMC. Alternatives 5, 7, and 9 are identical with respect to the drainage features above the FMC, and HELP modeling indicates that the majority of the precipitation will be removed by these layers. Of the moisture that penetrates these drainage and barrier layers and enters the gas collection geocomposite, a small portion will likely drain downslope in the geonet layer; however, a larger portion of this moisture will drain through the geonet into the underlying geotextile and soak into the general fill layer.*

*Currently, there are no plans to prevent moisture from entering the gravel columns; however, since the cross-sectional area of these columns will be small in comparison to the area of the general fill, the likelihood of moisture reaching the columns and the impact it will have on the overall water balance is reduced. Once surface water has migrated through the cover section, it will ultimately migrate into the waste, regardless of whether it flows in the gravel columns or directly through the general fill placed to achieve the design surface grades. The only impact of the gravel columns will be to decrease the time for that water to reach the waste. However, in large areas of the landfill, the grading fill will be of limited thickness and therefore will not impede the rate of migration.*

**CDPHE August 1996**
**Refers to CDPHE Comment 21, Page J-28**
**Comment 53**

A review of Richardson and Koerner (1987)did not find a listing of geonets suitable for use in gas venting systems. On the contrary the referenced documents states, "genoets are extruded nets formed by extruding and bonding up to three layers of polymer rods oriented at acute angle

to each other. They have significant capacity of planar flow and are commonly used with geotextiles to form systems for **leachate or surface water collection/removal.**"

Daniel and Koerner (September, 1993 Technical Guidance Document: QA and QC for Waste Containment Facilities, EPA/600/R-93/182) states: Geonets are unitized sets for parallel ribs positioned in layers such that **liquid** can be transmitted within their open spaces. Thus their primary function is drainage.

Figure 6-2 indicates exclusive use of a geotextile/geonet/geotextile type geocomposite as a gas collection system which is situated directly beneath the low permeability soil layer. This configuration promotes excessive geotextile intrusion into the geonet apertures (e.g., as a result of overlying soil compaction operations) which could adversely impact flowrate.

Exclusive use of geocomposites which employ a geonet component o for the proposed gas collector system is unconventional and unacceptable. EPA guidance (Design and Construction of RCRA/CERCLA Final Covers and Requirements for Hazardous Waste Landfill Design, Construction, and Closure) indicates that a gas collection system composed of perforated pipes encased by granular soils is recommended. Solid pipes (as opposed to gravel columns) are connected to the perforated pipes for gas venting or conveyance to treatment facilities, if required.

### Response to Comment 53

*EPA 625/4089/022, Requirements for Hazardous Waste Landfill Designs, Construction and Closure, P. 66, uses a geotextile for gas collection and removal for a design examples. A geonet would have a much higher transmissivity that a geotextile.*

*Prior to revising the Decision Document, information concerning the application of geosynthetics in gas venting systems will be further researched and information submitted for review.*

### Excerpt from response to CDPHE 21, Page J-28

*Once surface water has migrated through the cover section, it will ultimately migrate into the waste, regardless of whether it flows in the gravel columns or directly through the general fill placed to achieve the design surface grades. The only impact of the gravel columns will be to decrease the time for that water to reach the waste.*

### CDPHE August 1996
### Comment 54

The response states, "Once surface water has migrated through the cover section, it will ultimately migrate into the waste, regardless of whether it flows in the gravel columns or directly through the general fill placed to achieve the design surface grades. The only impact of the gravel columns will be to decrease the time for that water to reach the waste."

Surficial moisture must not circumvent the over barrier system via migration through the gravel column conduits. Also, gravel columns would be subject to clogging from sediments carried by surficial runoff as it penetrated the cover layers. This situation could adversely impact the effectiveness of the proposed gas collection system.. The effectiveness of using gravel column's for transport of landfill gas to a potential treatment system is also questionable. Solid pipes should be used in lieu of gravel columns to convey landfill gas and to inhibit accelerated percolation of surface water into the underlying waste.

### Response to Comment 54

*The options for gas venting systems will be reevaluated in the next revision of the Decision Document.*

### EPA March 1995
### Comment 25, Page J-29
### Landfill Design

Section 5.1.5.1 (Page 5-4). A 36-in. vegetative-soil layer does not allow for a factor of safety for barrier layer protection in case depth of frost penetration is greater than 3 ft. It is recommended that a ft-thick biota layer consisting primarily of cobble-size material be incorporated into the cover design. A biota layer would provide the dual benefits of cover protection from burrowing animals as well as increasing the thickness of soils above the barrier layer materials, resulting in additional frost protection. The top soil and vegetative soil layer specifications must be addressed in the Title II design document.

### Response

*The frost depth in the area of OU 7 is 3 ft. Therefore, the existing design will provide adequate frost protection. A review of site-specific biologic conditions at OU 7 indicates that a biotic barrier is necessary. However, the geosynthetic drainage layer also serves this purpose. The cover dimensions are preliminary. They will be further refined during Title II design.*

*The top soil and vegetative soil layer specifications will be included in the Title II design document.*

**CDPHE August 1996**
**Comment 55 (refers to CDPHE Comment 25)**

A review of the literature indicates that the frost protection layer in this region should be at least 1.25 meters (introductory Soil Mechanics and Foundations: Geotechnical Engineering, G. F. Sower, 4th Edition, 1979). The total depth of the cover materials above the low permeability zone layer should be a minimum of 1.25 meters (4.1 feet). This thickness will also help minimize low permeability zone layer material desiccation after construction.

**Response to Comment 55**

*Prior to Title II Design, studies will be performed to determine the frost protection layer at the RFETS.*

**CDPHE August 1996**
**Comment 56**

The response states: A review of site-specific biologic conditions at OU 7 indicates that a biotic barrier is necessary . However, the geosynthetic drainage layer also serves this purpose.

The proposed geosynthetic drainage layer and the underlying FMC may be subject to damage/malfunction resulting from burrowing animal activity. EPA guidance (Requirements for Hazardous Waste Landfill Design, Construction, and Closure) states: A biotic barrier is a gravel and rock layer designed to prevent the intrusion of burrowing animals into the landfill area. This protection is primarily necessary around the cap but, in some cases, may also be needed at the bottom of the liner. Animals cannot generally penetrate a FMC, but they can widen an existing hole or tear the material where it has wrinkled.

EPA guidance (design and Construction of RCRA/CERCLA Final Covers) also state: Plant roots or burrowing animals (collectively called biointruders) may disrupt the drainage and the low hydraulic conductivity layers to interfere with the drainage capability of the layers. A 90-cm (3-ft) biotic barrier of cobbles directly beneath the top vegetation layer may stop the penetration of some deep-rooted plants and the invasion of burrowing animals.

An appropriate biota layer must be included in the cover design to protect the proposed geosynthetic drainage layer. Alternatively, a properly designed cobble/gravel biota layer may also serve as the surface water collection/drainage layer. however, a suitable bedding material would be necessary to protect the underlying FMC.

**Response to Comment 56**

*Prior to revision of the document, information regarding the application and success of geosynthetics used as biotic barriers will be gathered and presented for review. At that time, the site-specific requirements of a biotic barrier at RFETS can be refined.*

**CDPHE March 1996**
**Comment 26, Page J-30**
**Landfill Design**

Section 5.1.5.4 (Page 5-6). Geocomposites are a combination of geonet and geotextile and are not normally considered appropriate for gas collection. Please see comment #21 above.

**Response**

*Richardson and Koerner (1987) list geonets and geotextiles suitable for use in gas venting systems.*

**CDPHE August 1996**
**Comment 57**
**Refers to CDPHE Comment 26 page J-**

The response states: Richardson and Koerner (1987) lists goenets and geotextiles suitable for use in gas venting systems.

See Comment #53 above.

**Response to Comment 57**

*Prior to revision of the Decision Document, information regarding the application of geonets and geotextiles in gas venting systems will be gathered and presented for review.*

**CDPHE March 1996**
**Comment 30, Page J-30**
**Landfill Design**

Section 5.2.7 (Page 5-11). This section states advantages of the Alternative 7 soil cover: "The presence of the low-permeability soil (approximately 1E-05 cm/sec) gives the cover system some of the benefits of a composite cover without the rigorous installation requirements of a full

compacted clay. The barrier layer is an FMC with a permeability of approximately 1E-13 cm/sec. The gas-collection system is designed to facilitate gas treatment if needed."

Calling a soil with a permeability of 1E-05 cm/sec a "low-permeability" soil is a misnomer. Permeabilities of this magnitude are associated with clayey sand and silty sand soils. These soil types are primarily coarse-grained and tend to have significantly higher permeabilities than fine-grained soil types.

Page G-4 of the appendices states that the results of this [sensitivity] analysis show that the permeability of the soil underlying the FMC has significant effect on leakage rates through defects in the FMC. The decreased protectiveness of substituting the "low-permeability" soil in place of clay below the FMC should be compensated for by the addition of a GCL (or equivalent) component to the barrier layer.

Page G-3 of the appendices states that the FMC is modeled using default geosynthetic material characteristic #35, which has a hydraulic conductivity of 2E-13 cm/sec. A typical thickness for FMCs of 60 mils (.06 in.) was used. The proposed FMC to be used in the cover should be consistent with the 60-mil FMC used in the HELP model.

## Response

*The permeability of soils can range from 1E+2 to 1E-9 cm/sec (Cedergren 1977). A soil with a permeability of 1E-5 cm/sec is on the lower end of this range and is indicated as a "poor drainage" material. Therefore, a soil with a permeability of 1E-5 cm/sec can be classified as "low permeability." However, we do realize that there are soils with lower permeabilities.*

*As indicated in Cedergren (1977), soils with permeabilities in the range of 1E-5 cm/sec consist of very fine sands; organic and inorganic silts; mixtures of sand, silt, and clay; glacial till; stratified clay deposits; and "impervious" soils that have been modified by the effects of weathering (freezing and drying). We have selected a low-permeability soil with a permeability classification of 1E-5 to 1E-9 cm/sec because that is a realistic permeability value that any soil could achieve in the long run in a cover application where it is exposed to the effects of weathering.*

*The state has suggested the use of a GCL on top of the low-permeability soil to improve the performance of the cover section. We have considered the use of a GCL in the cover section and have evaluated the performance with the HELP model. The results are presented in the text and indicate that the performance of a cover section with a GCL or a low-permeability soil are similar.*

*The proposed FMC material type and thickness will be determined in the final design. However, the HELP runs that have been completed are considered appropriate even if the selected FMC material is not a 60-mil material because the major component impacting the leakage rate of FMCs is the defect rate and not the material thickness.*

**CDPHE August 1996**
**Comment 58**
**Refers to CDPHE Comment 30 Page J-30**

The response states: The permeability of soil can range from 1E+2 to 1E-9 cm/sec (Cedergren 1977) A soil with a permeability of 1E-5 cm/sec is on the lower end of this ranges and is indicates as a "poor drainage" material. Therefore a soil with a permeability of 1E-5 cm/sec can be classified as "low permeability". However, we do realize that there are soils with lower permeabilities.

See reply to Response to EPA J.2.3 Landfill Design Comment 1 (Comment #45 above.)

A "poor drainage" soil is a poor drainage soil and is not considered to be a "low permeability" soil. A coefficient of permeability of 1E-07 or less distinguishes "impervious" soils (An Introduction to Geotechnical Engineering , Robert D. Holtz and William D. Kovacs, (1981). We acknowledge that a coefficient of permeability equal to 1E-05 qualifies as a "poor: drainage material. A coefficient of permeability equal to 1E-07 qualifies as a "practically impervious" drainage material (An Introduction to Geotechnical Engineering. Holt and Kovacs, 1981) and must be used as a minimum criteria for the low permeability zone cover soils.

**Response to Comment 58**

*The low permeability soil cover option will not be evaluated in the next revision of the Decision Document. The discussion of "poor drainage" and "low-permeability" soils will be removed.*

**CDPHE August 1996**
**Comment 59**
**Refers to CDPHE March 1996 Comment 30, Page J-30**

The response states : We have selected low-permeability soil with a permeability classification of 1E-5 to 1E-0 cm/sec because that is a realistic permeability values that an soil could achieve in the long run in a cover application where it is exposed to the effects of weathering.

The above statement is debatable. Capping Option E, which employs a soil with a coefficient of permeability of approximately 1E-5 to 1E-7 (not 1E-9) cm/sec, was selected for used in the

detailed analysis. However, the low permeability zone layer soil must have a coefficient of permeability of **no more than** 1E-07 cm/sec

**Response to Comment 59**

*The low permeability soil cover option will not be evaluated in the next revision of the Decision Document. The discussion of low-permeability soil will be removed from the text.*

**CDPHE August 1996**
**Comment 60**
**Refers to CDPHE March 1996 Comment 30, Page J-30**

The suggested used of GCL was not intended to replace the low-permeability soil but to supplement it. Moreover, modeling indicates that the annual leakage rate of Cover Option E (Single Barrier FMC with a Low-Permeability Cover) is about 8,000 times greater than the annual leakage rate of Cover Option F (Composite Barrier FMC and GCL Cover).

**Response to Comment 60**

*Once the RFCA Implementation Document is approved and DOE, EPA and CDPHE come to consensus on an appropriate leachate management option from Comment #28 (CDPHE June 1996), cover options will be reevaluated.*

**CDPHE March 1996**
**Comment 34, Page J-32**
**Landfill Design**

Section 6.2.2.2 (Page 6-13). It is debatable whether the vegetative soil layer prevents punctures of the FMC by plant roots and burrowing animals. Please see comment #25 above.

**Response**

*The dimensions given on the cover alternates are preliminary. Further refinement for the design layer thickness will occur during the Title II design where issues such as frost burial depth, evaporation zone depth, burrowing animal depth, and plant root depth will be specifically addressed.*

**CDPHE August 1996**
**Comment 61**
**Refers to CDPHE March 1996 Comment 34**

Evidently, further refinement for the design layer material types also needs to occur prior to the Title II design. Frost burial depth is currently being specifically addressed (see Comment #53 above). Evaporation zone depth should also be addressed now since it affects the potential for low permeability zone layer desiccation which is the primary basis given for not selecting compacted clay.

**Response to Comment 61**

*Frost burial depth and Evaporation zone depth will be determined prior to commencement of Title II design.*

**CDPHE March 1996**
**Comment 35, Page J-32**
**Landfill Design**

Section 6.2.3.1 (Page 6-13). It is debatable whether the installation requirements for the "low-permeability" soil would be less rigorous than those of a full clay liner.

The 1-ft lift thickness mentioned in this section may not provide sufficient cushion to prevent geonet damage or eliminate intrusion of adjacent materials into the geonet apertures during lift placement. All soil layer material specifications must be addressed in the Title II design document.

**Response**

*Placement of soil materials over geosynthetics can be performed without damage to the geosynthetics with good construction quality assurance (CQA) monitoring and control.*

*Intrusion of adjacent materials into geonet apertures in a geocomposite is affected by the type of overlying geotextile and the amount of soil overburden placed on top of the geocomposite. We concur that all soil layer material specifications must be addressed in the Title II design document. In addition, geosynthetic material specifications and CQA plan must also consider compatibility of soil materials and placement practices with the geosynthetics.*

**CDPHE August 1996**
**Comment 62**
**Refers to CDPHE March 1996 Comment 35**

Compacting a single 1-ft lift of soil materials over geosynthetics may not provide sufficient cushion to prevent geonet damage or eliminate intrusion of adjacent materials into the geonet apertures during construction. Intrusion of adjacent materials into the geonet apertures is also affected by the energy imparted to the overlying soils as a result of required compaction operations. This response also fails to address why installation requirements for the "low permeability" soil would be less rigorous than those of a full clay liner. The document should also state that the CQA plan will also include soil placement practices.

### Response to Comment 62

*A geonet will have filter geotextiles to prevent intrusion. Geonet composites are designed to withstand loading and prevent soil intrusion when used for liner systems which have much higher loading (up to 100 feet or more of soil/waste) than covers with 3-feet of soil.*

*The low-permeability soil cover option will not be evaluated in the next revision of the Decision Document.*

*The document will be revised to state that the CQA plan will also include soil placement practices.*

### CDPHE March 1996
### Comment 36, Page J-33
### Landfill Design

Section 6.2.3.2 (Page 6-14). Specify the ways in which Alternative 7 does not comply with EPA guidance cited, and then explain how this alternative is nevertheless equally protective.

### Response

The regulatory criteria for the barrier layer soil component is described as having a 2-ft barrier with saturated conductivity of less than or equal to 1E-07 cm/sec. Alternative design for this component is 1-ft thick with a hydraulic conductivity of 1E-05 cm/sec. This is the only component in the cover system that deviates from the EPA guidance documents. The barrier soil component proposed in Alternative 7 will be a low-plasticity soil that will be less susceptible to desiccation cracking than a high-plasticity clay layer of the type typically installed in conformance with EPA guidance. The leakage rate for the Alternative 7 cover is greater than the Alternative 9 cover; however, when both leakage rates are compared as a percent of the average annual rainfall they both perform at a similar level.

**CDPHE August 1996**
**Comment 63**
**Refers to CDPHE Comment 36**

The comparison of leakage rates as a percent of the average annual rainfall is not valid. This analysis neglects to consider the acute impacts of saturated conditions which prevail during the spring runoff/snowmelt time frame. This analysis also neglects interflow effects. Moreover, the annual leakage rate of Cover Option E (Single-Barrier FMC with a Low-Permeability Cover) is about 16 times greater than the annual leakage rate of Cover Option G (Composite-Barrier FMC and Clay Cover).

**Response to Comment 63**

*The comparison of leachate rates as a percent of the average annual rainfall will not be used in the next revision of the Decision Document. Although the Leakage rate of the Cover Option E is 16 times greater than the annual leakage rate of Cover Option G, both meet the CHWMA requirements. After consensus is reached concerning comment #28 (CDPHE June 1996) and the RFCA implementation document is approved, cover alternative will be reevaluated.*

**CDPHE August 1996**
**Comment 37, Page J-33**
**Landfill Design**

Section 6.3.1 (Page 6-21). This section states that the low-permeability soil layer may be less permeable than the clay barrier layer due to its resistance to desiccation. However, clay is the standard soil material used for landfill covers. Desiccation will be minimized since the clay will be buried at depth and not subject to surficial drying. It is debatable that Alternative E (previously Alternative 7) affords the highest degree of long-term effectiveness and permanence. This point is the major basis for giving Alternative 7 a higher score in Long-Term Effectiveness and Permanence.

**Response**

*In general, factors that influence clay layer desiccation include the clay mineralogy, plasticity, sand content, initial moisture content, temperature variations, nature of the clay's contact with overlying geomembrane or underlying surface, and overburden pressures. These factors have been investigated by several researchers, and it has been suggested that a clay layer having a lower swelling potential, lower plasticity index, lower initial moisture content, and a thicker vegetative soil cover that provides sufficient temperature insulation and overburden pressure to maintain a tight contact between the clay and the overlying geomembrane will be less likely to*

*desiccate than a clay layer that does not have these characteristics. The ability of a clay to rehydrate after cracking is very dependent on the characteristic of the clay. A pure bentonitic clay such as GCL will hydrate and achieve a permeability similar to a pre-drying condition; however, normal compacted clay covers may not have the potential to totally rehydrate and achieve a permeability equal to the pre-drying permeability.*

*The low-permeability soil layer proposed for Alternative E is intended to incorporate many of the factors identified above to reduce the potential for clay desiccation compared to the clay layer proposed in Alternative G (previously Alternative 9).*

**CDPHE August 1996**
**Comment 64**
**Refers to CDPHE Comment 37**

See reply to Response to EPA J.2.3 Landfill Design Comment 1 (Comment #45 above)

**Response to Comment 64**

*The low-permeability soil cover option will not be evaluated in the next revision of the Decision Document.*

**CDPHE March 1996**
**Comment 38, Page J-34**
**Landfill Design**

Section 6.3.3.1 (Page 6-21). This section states that if "new clay borrow sources are selected to repair the clay layer in Alternative 9, it may be necessary to complete a new test fill and chemical compatibility tests for that clay material." However, the clay layer is proposed to be placed above the landfill waste so chemical compatibility should not be a concern. Even so, if chemical compatibility testing is to be performed, it would have to be performed on the low permeability soil also.

**Response**

*Compatibility testing for a new clay material to be used for clay layer repairs may not be a major concern due to the fact that the clay layer is placed above the waste layer.*

**CDPHE August 1996**
**Comment 65**

Response to CDPHE Comment 21 states: "some infiltration of gas into the soil layer will occur but the majority of the gas will flow through the openings in the geonet and the geotextile." Also, seasonal fluctuations, capillary action and interflow also may cause groundwater contact with the clay layer. These factors indicate that chemical compatibility of the low permeability zone layer materiel will be required.

**Response to Comment 65**

*Chemical compatibility testing will be conducted as necessary.*

**CDPHE March 1996**
**Comment 39, Page J-34**
**Landfill Design**

Section 6.3.3.1 (Page 6-21). The text states that, "the clay barrier in Alternative G is more difficult to construct than the low-permeability soil layer or the bedding soil layer due to required moisture conditioning and maintenance of exposed clay during construction." The low-permeability soil layer would also be subject to moisture conditioning and maintenance during construction.

**Response**

*The low-permeability soil will require moisture conditioning during placement. This is expected to reduce the potential for desiccation cracking and associated repair during construction. Both of these factors are expected to facilitate placement, compaction, trimming, and CQA monitoring activities (see response to comment 35).*

**CDPHE August 1996**
**Comment 66**
**Refers to CDPHE March 1996 comment 39**

See reply to Response to CDPHE Comment 36 (Comment #62 above).

**Response to Comment 66**

*The low-permeability soil cover option will not be evaluated in the next revision of the Decision Document.*

*The document will be revised to state that the CQA plan will also include soil placement practices.*

**March 1996**
**CDPHE Comment 41, Page J-34**
**Risk Assessment**

Section 7.1 (Page 7-2). There will be no potential exposure to groundwater not "because there are no plans for future development of groundwater" as stated in the sixth paragraph, but rather because institutional controls will prohibit it.

**Response**

*The text will be revised.*

**CDPHE August 1996**
**Comment 67**
**Refers to CDPHE Comment 41**

See Comment #28 which discusses various leachate issues.

**Response to Comment 67**

*Once consensus is reached concerning leachate management from Comment #28 (CDPHE June 1996), leachate discharge options will be reevaluated.*

**March 1996**
**Comment 42, Page J-34**
**Groundwater/Leachate Control**

Section 7.1 (Page 7-2). Leachate control does not exceed regulatory requirements despite the contrary statement on the fourth paragraph on this page. Because the landfill is an interim status closure unit, the requirements in 6 CCR 1007-3, §265.110 apply. The closure performance standard requires that the post-closure escape of leachate be controlled, minimized or eliminated.

**Response**

*The referenced standard states that "the owner must close the facility in a manner that:...controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of... leachate." A focused risk assessment for the leachate showed no risk to human health. An ecological risk assessment indicated unacceptable risk for direct contact. Therefore, in the IM/IRA DD, alternatives were developed that control, minimize,*

*or eliminate the post-closure escape of leachate. Alternatives include cap, slurry wall, treatment of the leachate and elimination of the exposure pathway.*

**CDPHE August 1996**
**Comment 68**
**Refers to CDPHE March 1996 Comment 42**

See replies to Responses to CDPHE Comments 13, 15 and 41 (Comment #51, #52, and #41 above).

**Response to Comment 68**

*Once consensus is reached concerning leachate management from Comment #28 (CDPHE June 1996), leachate discharge options will be reevaluated.*

**CDPHE March 1996**
**Comment 48, Page J-36**
**Landfill Design**

Section 7.3.1.1 (Page 7-10). This section says that maximum settlements may range from 2.9 to 5.5 ft. Localized ponding of water on top of the cover will not be permitted. Also see comment #45 above.

**Response**

*In general, settlement is a function of waste thickness and waste type. Several methods were used to estimate the amount of settlement at various points in the landfill cover. Based on these evaluations and allowing for worst case settlements, the cover system will have post settlement slopes between 3 and 5 percent.*

*We concur there is a possibility of local settlement that might result in localized ponding but we feel that this is remote due to the thickness of the general fill, which will further consolidate the waste, and components of the waste that reduce settlement potential, such as the construction debris component and the daily cover soil component. Localized settlement generally occurs when biodegradable materials or containers located near the upper surface of the waste fill deteriorate and collapse resulting in depressions at the surface. However, these localized settlements are observable on the surface and are relatively easy to repair. Any localized settlement will be repaired as described in the Postclosure Plan.*

**Comment 69**
**Refers to CDPHE Comment 48**

Settlement is also a function of loads placed above the waste material.

**Response to Comment 69**

*Agreed. Supporting text will be modified to state that settlement is also a function of load placed above the waste material.*

**CDPHE August 1996**
**Comment 70**
**Refers to CDPHE March 1996 Comment 48**

The addition of general fill, construction debris and dial cover soil will either increase the loading or increase void spaced resulting in a greater (not less) potential differential settlement. After cover installation, waste consolidation causes (rather than diminishes) differential settlement.

**Response to Comment 70**

*It is acknowledged that the addition of general fill, construction debris and daily cover soil can increase loading or increase void space resulting in greater potential differential settlement. Also it is acknowledged that after cover installation , waste consolidation can cause local differential settlement. Finally it is acknowledged that localized settlements may cause damage to proposed cover components which may not be easy to repair. Failures at other landfill will be researched to determine if there are any precautions or CQA items that can be implemented during the cover installation to minimize local differential settlement.*

**March 1996**
**Comment 51, Page J-37**
**Landfill Design**

Section 7.3.3 (Page 7-12). A manufacturer's QA report should be provided with any type of FML and geocomposite

**Response**

*Manufacturer's material specification and quality assurance test data are typically provided to customers upon request. In addition, it is common to obtain samples of this material when it arrives on site and to perform conformance tests to ensure that the material meets specifications. The manufacturer's product data, conformance sampling protocols, sample frequency, and types of tests to be performed will be called out in the Title II design specifications and construction quality assurance plan.*

**CDPHE August 1996**
**Comment 71**
**Refers to CDPHE March 1996 Comment 51**

The Title II design specifications should also incorporate the manufacturer's installation procedures.

**Response to Comment 71**

*The Title II design specifications will also incorporate the manufacturer's installation procedures.*

**March 1996**
**Comment 52, Page J-38**
**Groundwater/Leachate Control**

Section 7.3.4 (Page 7-13). Where will the seep water collected by the gravel blanket or French drain be directed?

**Response**

*As described in the response to Comment 2 of the Executive Summary, the preferred alternative for groundwater/leachate control is natural attenuation and seep water discharge to groundwater.*

**CDPHE August 1996**
**Comment 72**
**Refers to CDPHE March 1996 Comment 52**

See replies to Responses to CDPHE Comments 13, 15 and 41 above (Comments #51, #52, and #67).



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**Response to Comment 72**

*Once consensus is reached concerning Comment #28 (CDPHE June 1996), leachate discharge options will be reevaluated.*

**March 1996**
**Comment 57, Page J-39**
**Groundwater/Leachate Control**

Section 8.1.1 (Page 8-3). The discussion of the leachate in the third paragraph in this section should be modified to be consistent with comment 13 above.

**Response**

*The discussion will be modified to be consistent with the response to Comment 13.*

**CDPHE August 1996**
**Comment 73**
**Refers to CDPHE Comment 57, March 1996**

See reply to Response to CDPHE Comment 15 (Comment #52 above).

**Response to Comment 73**

*Discussion of leachate will be consistent with the outcome of discussions with EPA, CDPHE and DOE concerning Comment #28 (CDPHE June 1996).*